

Discovery of Universal Phonon Thermal Hall Effect in Crystals

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Thermal Hall effect (THE) in insulators is a remarkable phenomenon that arises from the motion of chargeless quasiparticles under a magnetic field. While magnons or various exotic excitations were considered as the origin of THE in some magnetic materials, there is more and more evidence suggesting that phonons play a significant role. However, the mechanism behind phonon THE is still unknown. Here we report the observation of THE, including planar THE, in a broad range of nonmagnetic insulators and semiconductors: SrTiO₃, SiO₂ (quartz), MgO, MgAl₂O₄, Si, and Ge. While the presence of antiferro-distortive domains in SrTiO₃ and chiral structure in SiO₂ may complicate the interpretation of THE, the striking observations of THE in trivial insulators MgO and MgAl₂O₄, as well as in high-purity intrinsic semiconductors Si and Ge, demonstrate that phonon THE is a universal property of crystals. Without other effects on phonons such as from magnons, this universal phonon THE is characterized by a scaling behavior of $|\kappa_{xy}| \sim \kappa_{xx}^2$. Our results experimentally discover a fundamental physics of phonons in the magnetic field, which should come from the direct coupling between atom vibrations and the field. Starting from this universal phonon THE in crystals, previous interpretations of THE in magnetic or nonmagnetic materials need to be reconsidered.

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The Hall effect as a fundamental phenomenon in condensed matter physics, plays a crucial role in investigating exotic quantum materials [1–4]. In conductors, it manifests as a transverse voltage difference caused by a longitudinal electrical current under a perpendicular magnetic field. However, in insulators, where the electrical Hall effect is ineffective due to the absence of charge carriers, the thermal Hall effect (THE) becomes important. THE arises from the motion of quasiparticles driven by a longitudinal temperature gradient in the presence of a magnetic field, leading to a transverse temperature difference. Over the past decade, nonzero thermal Hall conductivity κ_{xy} has been detected in a few insulators [5–15], yet its nature remains an open question.

To date, three distinct interpretations of the THE in insulators have been proposed, including magnons, various exotic excitations, and phonons. First, in ferromagnetic insulators, the large THE is attributed to magnons with the nontrivial topology of magnon bands [5–7]. Second, beyond magnons, THE has also been considered to arise from neutral spin excitations in frustrated quantum magnets such as Tb₂Ti₂O₇ [8] and Majorana fermions in α -RuCl₃ [9,16–18]. Particularly in honeycomb-lattice α -RuCl₃

[9,16,17], the observation of half integer quantized THE was argued to support the Majorana fermion's origin. Third, more and more evidence shows that phonons play an important role in the observed THE across a wider range of materials, including the paramagnetic insulators [10,19], multiferroic materials [12], cuprates [11,20,21], antiferromagnetic insulators [13,22], Kitaev materials [23,24], the metallic spin ice Pr₂Ir₂O₇ [25], and the van der Waals ferromagnet CrI₃ [26]. Interestingly, planar THE [here, “planar” refers to the field lying in the *xy* plane of the sample, as illustrated in Fig. 1(a)] has also been observed in several magnetic insulators with the origin related to phonons [27,28].

However, the mechanism for phonons to generate THE remains elusive. In the case of paramagnetic insulator Tb₃Ga₅O₁₂ [10], the phonon THE is linked to skew scattering with magnetic ions [29]. In magnetic insulators, the coupling of phonons to the magnetic environment is widely considered [7,12,13,20–22,30–33], and in some cases the chirality of phonons (acoustic phonons) is believed to be necessary [20]. Interestingly, the phonon THE has also been reported in two nonmagnetic insulators [14,15]. In SrTiO₃ (STO), THE is associated with antiferrodistortive (AFD) domains, which potentially lead to hybridization between acoustic and transverse optical phonons [14]. In black phosphorus (BP), the THE may stem from an intrinsic scenario where atomic vibrations can

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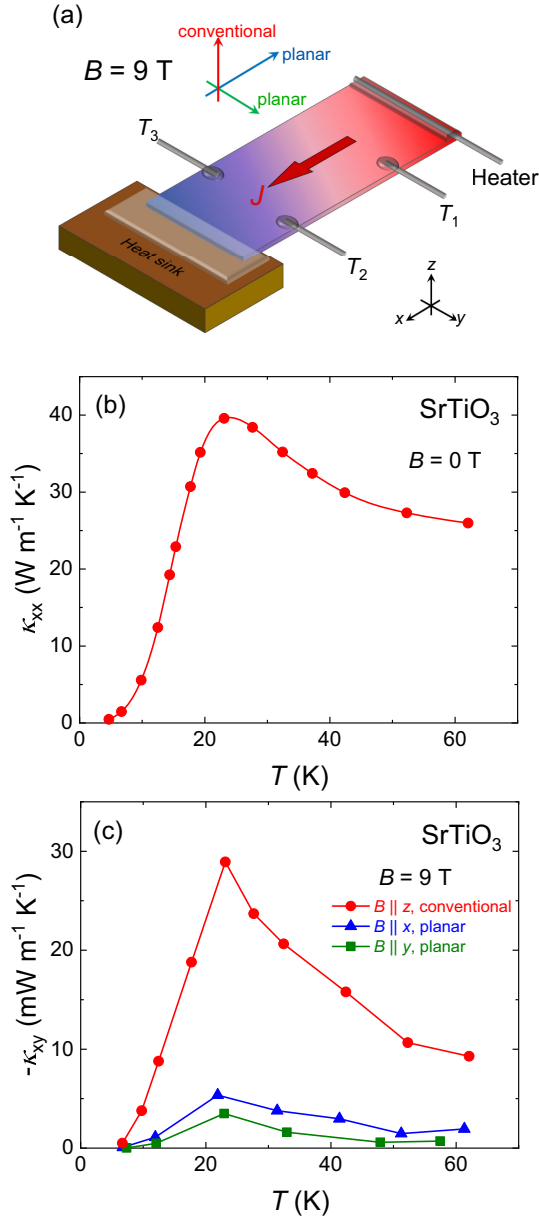


FIG. 1. (a) Schematic of the thermal transport experiment setup. The thermal current J is applied along x . The magnetic fields along three directions give the conventional configuration ($B \parallel z$) and two planar configurations ($B \parallel x$ and $B \parallel y$), which are shown with colored arrows. (b) Thermal conductivity κ_{xx} of SrTiO_3 single crystal as a function of temperature in zero field. (c) Thermal Hall conductivity κ_{xy} of SrTiO_3 measured at $B = 9$ T in different configurations as shown in (a), plotted as $-\kappa_{xy}$ vs T . The existence of κ_{xy} in two planar configurations is evident.

couple to the field due to the anisotropic charge distribution [15]. To further elucidate the essence of phonon THE in this context, it will be crucial to measure more nonmagnetic insulators, to check how often it can be observed and whether planar THE also exists.

In this Letter, we carry out systematic thermal Hall measurements on nonmagnetic single crystals, including

insulating SrTiO_3 , SiO_2 , MgO , and MgAl_2O_4 , as well as semiconducting Si and Ge . Firstly, we observe large conventional and planar κ_{xy} in nonmagnetic SrTiO_3 and SiO_2 , which indicates that planar THE does not depend on a magnetic environment and shares a common nature with the conventional THE. Secondly, the large κ_{xy} is also observed in trivial insulators such as MgO , MgAl_2O_4 , and high-purity elemental semiconductors Si and Ge , all of which follow the same scaling behavior of $|\kappa_{xy}| \sim \kappa_{xx}^2$. These findings demonstrate that phonon THE is a universal phenomenon in crystals (even with high purity), which reflects a fundamental physics of phonons (i.e., atom vibration) in the magnetic field. Therefore, the thermal Hall effect in all single crystals should be interpreted by starting from this universal phonon THE, before considering other extrinsic effects.

As shown in Fig. 1(a), we measure the thermal Hall effect with three thermometers with a magnetic field B along the $-x$, y , and z directions, respectively. Detailed methods are shown in Appendix A of End Matter. We start with thermal Hall measurements on STO to investigate the potential existence of planar THE ($B \parallel x$ and $B \parallel y$) in a nonmagnetic insulator, as shown in Fig. 1(a). Figures 1(b) and 1(c) show the thermal transport results of STO. The behavior of both κ_{xx} and conventional κ_{xy} ($B \parallel z$) is consistent with the results in a previous report [14]. Clearly, κ_{xy} shows up in both planar configurations ($B \parallel x$ and $B \parallel y$). Although the magnitude of the planar κ_{xy} is smaller than the conventional one, all three curves exhibit a peak around 20 K, following the κ_{xx} curve in Fig. 1(b). In this nonmagnetic material STO, the phonon is the only well-defined quasiparticle, leaving no doubt that THE comes from phonons. Our results show that planar phonon THE also exists in nonmagnetic material, without the need to interact with a magnetic environment.

We then direct our focus to the “chiral” crystal SiO_2 , since the chirality of phonons is often believed necessary for phonon THE. SiO_2 is characterized by a helical SiO_4 tetrahedra along [001] (see the Supplemental Material, Fig. S3 [34]). A recent study has detected chiral phonons carrying magnetic moment in SiO_2 using circularly polarized x-rays [43], which may provide a potential way for phonons to couple with the magnetic field. Although the x-rays focus on the optical phonons, which is different from the acoustic phonons that carry heat, this Letter still motivates us to check whether there is a large phonon THE due to the potential coupling between optical and acoustic phonons [14]. As illustrated in Fig. 2(b), SiO_2 shows a significant κ_{xy} in an out-of-plane field. The peak amplitude reaches approximately $1.8 \text{ W m}^{-1} \text{ K}^{-1}$, comparable to values reported in materials where the κ_{xy} is considered “large,” such as Cu_3TeO_6 [13] and BP [15]. Large planar κ_{xy} with both $B \parallel x$ and $B \parallel y$ is also observed in SiO_2 with values exceeding half of the conventional κ_{xy} , further confirming our finding in STO.

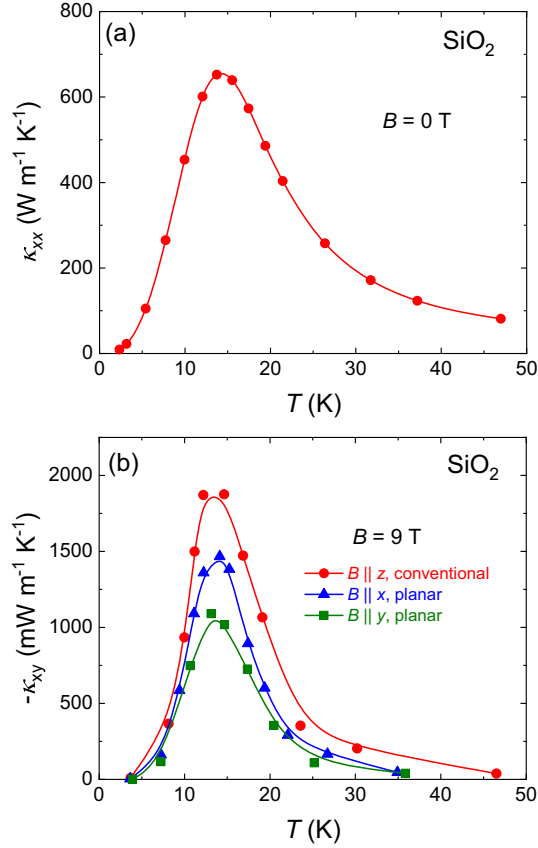


FIG. 2. (a) Thermal conductivity of SiO_2 in zero field, plotted as κ_{xx} vs T . It shows a phonon peak around 15 K. (b) Thermal Hall conductivity κ_{xy} of SiO_2 measured at $B = 9 \text{ T}$ in conventional and planar configurations shown in Fig. 1(a), plotted as $-\kappa_{xy}$ vs T . The large $\kappa_{xy}(T)$ in all configurations closely follows $\kappa_{xx}(T)$.

Given the unique crystal structure for chiral phonons in SiO_2 , one might not expect to observe the THE in a trivial insulator like MgO . Our motivation to measure MgO is to take it as a standard crystal without phonon THE. However, to our surprise, a large κ_{xy} is also observed [Fig. 3(b)]. It is evident that the shape of the $\kappa_{xy}(T)$ curve for MgO closely follows the phonon peak on its $\kappa_{xx}(T)$ curve, resembling that of STO and SiO_2 . It is important to note that MgO possesses a trivial crystal structure, which poses a challenge to those interpretations related to the domain in STO or chiral structure in SiO_2 . To explain this phonon THE in MgO , we notice that Flebus and MacDonald recently proposed an intrinsic scenario emphasizing the influence of the Lorentz force on ionic vibrations without the coupling of acoustic phonons to extrinsic factors [44]. In this scenario, the in-phase motion of cations and anions couples with the out-of-phase motion under magnetic field, thereby generating a finite thermal Hall signal.

If this ionic scenario of the phonon THE is correct, one may not expect to observe THE in an elemental crystal. Therefore, we choose to measure the high-purity elemental intrinsic semiconductor Si. Strikingly again, a large κ_{xy} is

also observed in Si [Fig. 3(d)]. An intrinsic Si single crystal has a 1.12 eV band gap. According to the Wiedemann-Franz law, the electron contribution to κ_{xy} can be neglected at low temperature. Thus, the large κ_{xy} must entirely come from phonons, and the effect of impurity is also negligible in this high-purity single crystal. Its peak magnitude is about $10 \text{ W m}^{-1} \text{K}^{-1}$, which is the largest in all reported crystals so far. We also observe a large planar κ_{xy} in Si as seen in the Supplemental Material, Fig. S11 [34]. The observations of THE in STO , SiO_2 , MgO , and Si finally let us realize that the phonon THE is a universal phenomenon in all crystals, even with high purity like Si. In this context, the special AFD domain in STO or chiral structure in SiO_2 may only slightly affect this phonon THE, and the previous observation of large THE in an elemental BP single crystal [15] is also not surprising now. More measurements on another insulator MgAl_2O_4 with spinel structure and intrinsic semiconductor Ge are carried out to reinforce this discovery. As expected, both single crystals display a large κ_{xy} , shown in Fig. 3. To rule out the artifacts in phonon thermal Hall signals, we conducted a series of experiments and confirmed that the observed universal phonon THE is intrinsic to crystals, as shown in Appendix B of End Matter and the Supplemental Material [34].

This universal phonon THE is characterized by a scaling behavior between κ_{xy} and κ_{xx} , in the case that no other extrinsic factors affect phonons. The κ_{xy} of SiO_2 , MgO , Si, and Ge is proportional to the square of κ_{xx} , as depicted in Figs. 4(a)–4(d). The data of MgAl_2O_4 and the data of BP extracted from Ref. [15] are plotted in Fig. S9, which also shows a square dependence. Thus, a universal scaling behavior of $|\kappa_{xy}| \sim \kappa_{xx}^2$ for intrinsic phonon THE is presented in Fig. 4(e). For SiO_2 , the data of all three configurations are plotted. Note that for BP in Ref. [15], the x and z axes are defined in the plane and the y axis is defined as being perpendicular to the plane; therefore the universal scaling behavior is $|\kappa_{xz}| \sim \kappa_{xx}^2$. The scaling behavior is particularly relevant in the context of anomalous Hall effect studies, where distinct scaling relations originate from various mechanisms [1,45]. For instance, localized hopping is indicated by $|\sigma_{xy}| \sim \sigma_{xx}^{1.6}$, while skew scattering is represented by $|\sigma_{xy}| \sim \sigma_{xx}$. The similar scaling behavior in thermal transport reinforces our discovery regarding the universal phonon THE in crystals.

Now the fundamental question is how phonons are affected by the magnetic field, a phenomenon that has remained puzzling since the initial observation of phonon THE in $\text{Tb}_3\text{Ga}_5\text{O}_{12}$ [10]. We observed a planar thermal Hall effect in SrTiO_3 , SiO_2 , and Si, which in principle should be forbidden by their high crystal symmetry theoretically [46]. Therefore, the underlying mechanism should involve some symmetry breaking with other origins. The first coming to mind is some extrinsic factors, such as impurities, defects, or domains, as discussed in the cases of

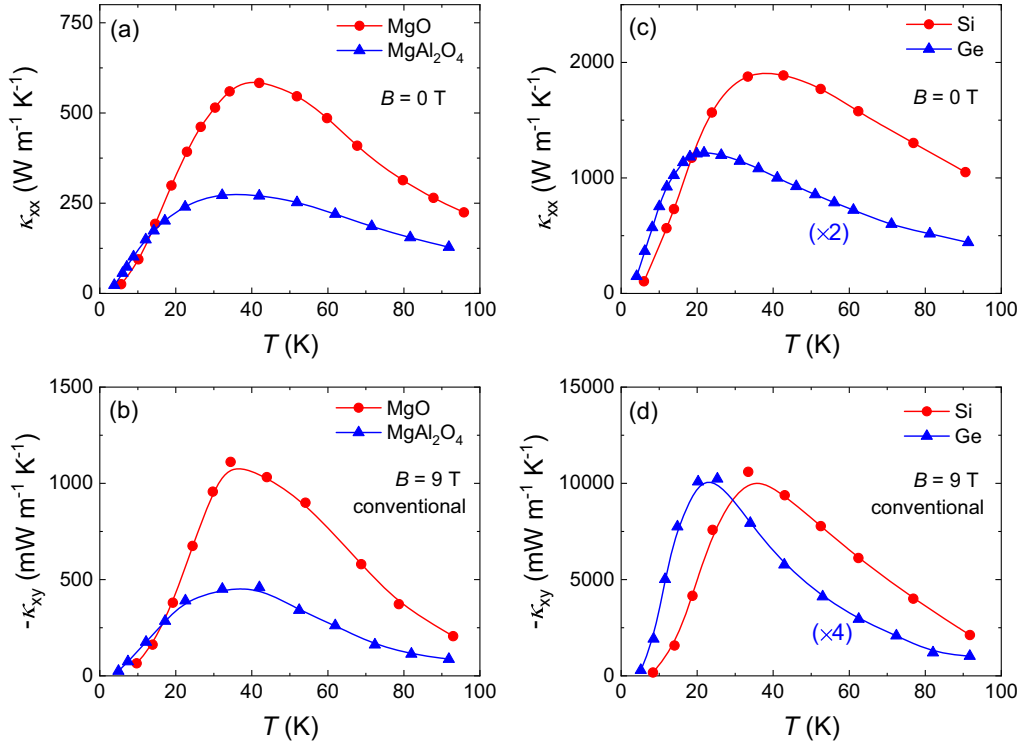


FIG. 3. (a) κ_{xx} of MgO and MgAl₂O₄ as a function of temperature in zero field. (b) κ_{xy} of MgO and MgAl₂O₄ measured at $B = 9$ T in the conventional configuration, plotted as $-\kappa_{xy}$ vs T . (c),(d) The same plots for κ_{xx} ($B = 0$ T) and κ_{xy} ($B = 9$ T) in the case of Si and Ge single crystals. All samples show large $\kappa_{xy}(T)$, following the temperature dependence of $\kappa_{xx}(T)$.

Na₂Co₂TeO₆ [28] and cuprates [27]. However, the high quality of our nonmagnetic single crystals, especially the high-purity Si and Ge (with purity higher than 4N), leaves

little room for extrinsic mechanisms such as impurity scattering and AFD domains. In this context, it is essential to consider an intrinsic mechanism—specifically, the direct

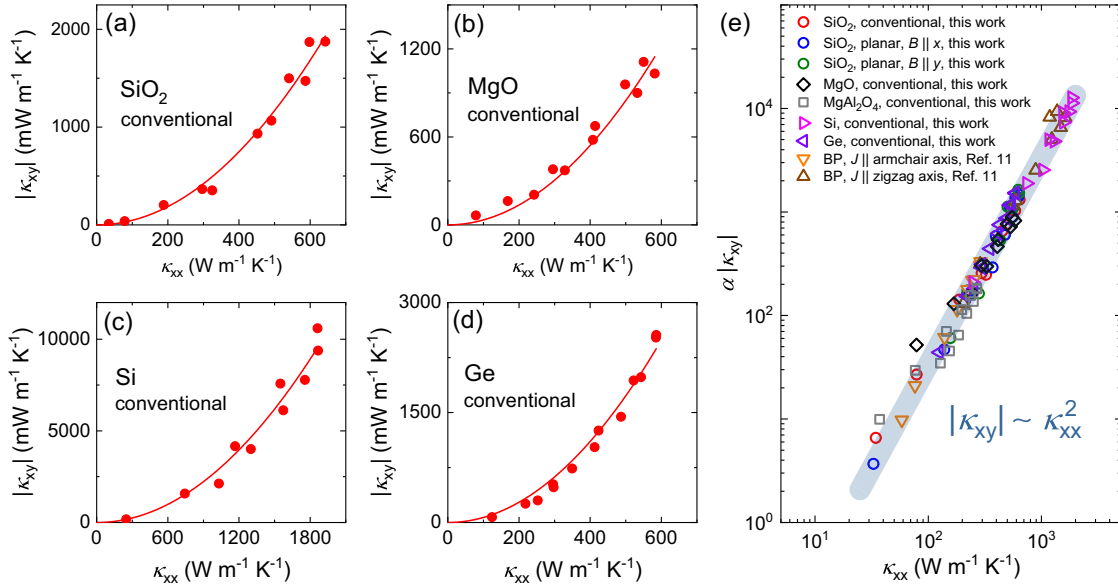


FIG. 4. (a),(b),(c),(d) $|\kappa_{xy}|$ plotted as a function of κ_{xx} for SiO₂, MgO, Si, and Ge. The experimental data can be fitted by a function of $|\kappa_{xy}| = A\kappa_{xx}^2$ (the red line). The fittings for the data of MgAl₂O₄ and black phosphorus are shown in the Supplemental Material, Note 7 [34]. For SiO₂, the data of three configurations can all be fitted by $|\kappa_{xy}| = A\kappa_{xx}^2$ as shown in the Supplemental Material, Note 8 [34]. (e) The scaling behavior for nonmagnetic insulators and semiconductors. To facilitate a better comparison, the κ_{xy} of these insulators and semiconductors is multiplied by a factor of α . The α for different materials is listed in Table S3 in the Supplemental Material, Note 9 [34].

coupling of the magnetic field on the atomic vibrations during phonon propagation—as the underlying cause of this universal phonon THE.

Our results reveal this coupling from two aspects. First, in the case of quartz, we applied the magnetic field in three directions: conventional ($B||z$) and planar ($B||x$ and $B||y$). As shown in Fig. S10, the plots of $|\kappa_{xy}(T)|$ vs $\kappa_{xx}(T)$ in these three configurations all follow the same scaling behavior and can be merged by multiplying κ_{xy} with $\alpha = 0.7, 1, 1.5$, respectively. Clearly, the planar phonon THE shares the same origin as the conventional one, and phonons can couple to a magnetic field in different directions with varied coupling strength. Second, for different materials, Fig. 4 shows thermal transport data for our samples and previously reported elemental black phosphorus [15], all of which demonstrate a consistent scaling behavior. Therefore, the universal phonon THE is a fundamental property of phonons regardless of different crystal structures. A more fundamental physical mechanism should be considered in solids. Although the ionic vibration scenario [44] may explain the thermal Hall phenomena in SiO_2 and MgO , it is insufficient in elemental Si and Ge. Prior theoretical works [47–49] have proposed that the coupling between acoustic phonons and the magnetic field could be facilitated through the Berry connection, generated by generic electron-phonon coupling in solids, even in elemental Si [47]. By focusing on the motion of charge induced by lattice vibrations, the field-direction-dependent phonon THE in quartz can also be understood, as lattice vibrations can provide charge motion in any direction, which then couples to the magnetic field. Therefore, although current intrinsic models still fall short of quantitatively explaining the observed phonon THE, we suggest that a deeper understanding of the interaction between electrons and lattice vibrations is essential for elucidating the fundamental physics underlying phonon THE. Importantly, symmetry breaking should be involved in this kind of intrinsic mechanism. Starting from this universal phonon THE in crystals, a reconsideration of prior THE results is warranted, as discussed in Appendix C of End Matter.

In summary, we have experimentally discovered a universal phonon THE in crystals, characterized by a scaling behavior of $|\kappa_{xy}| \sim \kappa_{xx}^2$, by measuring a series of nonmagnetic insulators and intrinsic semiconductors, including STO, SiO_2 , MgO , MgAl_2O_4 , Si, and Ge. It shows that phonons do not require extrinsic factors to generate THE. This is counterintuitive since phonon itself is usually believed to not be directly affected by field. Our findings emphasize the direct coupling of atom vibrations to the magnetic field, and provide a unified perspective for the previously controversial nature of THE in various magnetic and nonmagnetic crystals. More investigations with deeper insights on the interaction between electrons and lattice vibrations in magnetic field, even for insulators,

are essential for quantitatively understanding this universal phonon thermal Hall effect.

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Data availability—The data that support the findings of this Letter are not publicly available upon publication because it is not technically feasible and/or the cost of preparing, depositing, and hosting the data would be prohibitive within the terms of this research project. The data are available from the authors upon reasonable request.

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End Matter

Appendix A: Methods—The thermal transport measurements were conducted in a physical property measurement system (Quantum Design) under a high-vacuum environment. The three-thermometer (Cernox 1050) method was employed to simultaneously measure the longitudinal and transverse thermal gradients. Crystals were cut and polished into rectangular platelets (see the Supplemental Material [34] for more information about the samples). The thermometers were connected to the sample by silver wires. The contacts were made of silver epoxy annealed at 100°C. A constant heat current Q was applied along the x axis lying in the basal plane of the single crystal, using a resistive heater connected to one end of the sample, generating a longitudinal temperature difference $\Delta T_x = T_1 - T_2$ [Fig. 1(a)]. The other end of the sample was attached to a heat sink with silver paint. The copper block was used as a heat sink. The thermal conductivity along the x axis was calculated as $\kappa_{xx} = (Q/\Delta T_x)(L/wt)$. By applying a magnetic field B along the $-x$, y , and z directions, respectively, a transverse gradient $\Delta T_y = T_3 - T_2$ was generated [Fig. 1(a)]. The thermal Hall conductivity was defined as $\kappa_{xy} = \kappa_{yy}(\Delta T_y/\Delta T_x)(L/w)$, where κ_{yy} is the longitudinal thermal conductivity along the y axis. We assumed $\kappa_{yy} = \kappa_{xx}$ for crystals with high symmetry (SrTiO_3 , MgO , MgAl_2O_4 , Si , and Ge), while for SiO_2 with a chiral crystal structure, κ_{yy} has been measured (the Supplemental Material, Fig. S8 [34]). The contamination from κ_{xx} in κ_{xy} due to contact misalignment is removed by performing field antisymmetrization of the transverse temperature difference ΔT_y , i.e., $\Delta T_y = [\Delta T_y(B) - \Delta T_y(-B)]/2$. The positive directions of magnetic field are illustrated by color arrows in Fig. 1(a). The high credibility of our experimental setup has been validated by measuring glass, Cu_3TeO_6 , VI_3 , and CrI_3 , and comparing with those results in previous reports (more details are available in the Supplemental Material [34]).

Appendix B: Verification on the intrinsic thermal Hall effect in the measured crystals—To further confirm the reliability of our novel discovery, we carefully examined

our experimental setup. Contamination of a thermal Hall signal may arise from two potential sources. One such source is the heat sink. In a previous study, a nonzero κ_{xy} was observed in $\text{Y}_2\text{Ti}_2\text{O}_7$, which was attributed to the temperature gradient on the Cu heat sink [8]. To investigate the influence of Cu heat sink, we conducted a comparative experiment using the sample of SiO_2 and found no detectable contamination of thermal Hall signals (More details are available in the Supplemental Material, Note 5 [34]). This finding is also supported by Ref. [21], which excludes the contamination from the Cu heat sink by comparing the results with different heat sinks (Cu vs LiF). Thus, it can be inferred that the observed nonzero κ_{xy} is intrinsic to the nonmagnetic sample $\text{Y}_2\text{Ti}_2\text{O}_7$. We note very recently, a sizable phonon THE with $|\kappa_{xy}/\kappa_{xx}|$ of 0.8×10^{-3} at 8 T was reported in $\text{Y}_2\text{Ti}_2\text{O}_7$ [42], further reinforcing our discovery. Another possible source of contamination could be errors from Cernox thermometers. However, this can be excluded by swapping two thermometers used to measure the transverse temperature difference (see the Supplemental Material, Note 5 [34] for further details). Further, we note that in the honeycomb-lattice magnet $\text{Na}_2\text{Co}_2\text{TeO}_6$, the planar phonon κ_{xy} arises when $B \parallel J$ while it becomes almost zero when $B \perp J$ (Ref. [28]). This field anisotropy of phonon κ_{xy} provides a promising way to check the experiment setup. Thus, we measure another honeycomb-lattice insulating magnet CrCl_3 in two planar ($B \parallel x$, $B \parallel y$) configurations with $J \parallel x$. Figure S6 in the Supplemental Material, Note 5 [34] shows the thermal Hall angle is finite with $B \parallel J \parallel x$ while it is roughly zero with $B \parallel y$ ($B \perp J$). If the thermal Hall signals measured in our samples were artifacts of the experimental setup, they would be observed in all measurement configurations. The zero thermal Hall signal with $B \parallel y$ ($B \perp J$) in CrCl_3 clearly excludes this possibility. We also excluded the heating effect by experiments on Si samples with different thicknesses [34]. Therefore, after all these careful examinations, including the comparisons between our results with early

results of glass, Cu_3TeO_6 , VI_3 , and CrI_3 , we are very confident that the thermal Hall signals we observe in the samples of STO, SiO_2 , MgO , MgAl_2O_4 , Si, and Ge are intrinsic, rather than artifacts.

Appendix C: Discussions on thermal Hall signals in various materials—The phonon thermal Hall effect has been reported in various previously reported materials, which usually were attributed to special features of materials. Now starting from this universal phonon THE in crystals, it is natural to consider various factors affecting phonon THE, such as structure domains, magnetic environment, and impurities.

For the nonmagnetic SrTiO_3 , an initial study suggested that structure domains play a crucial role in generating κ_{xy} , especially in comparison to the small signals in KTaO_3 [14], which has no structural transition. We also conducted a thermal Hall experiment on KTaO_3 . In contrast to the small signals in Ref. [14], a peak value of κ_{xy} approximately one third that of SrTiO_3 has been observed in our sample (Fig. S13). Therefore, structure domains may not be the primary determinant of phonon THE, but only affect the intrinsic phonon thermal Hall signals to some extent. As shown in Fig. S12, the plots of $|\kappa_{xy}|$ versus κ_{xx} for SrTiO_3 (both our data and the data extracted from Ref. [14]) deviate from the second power scaling behavior only in the low temperature region where domain scattering dominates. Concerning the small κ_{xy} of KTaO_3 in Ref. [14], we note their $\kappa_{xx}(T)$ curve exhibits an anomalous “kink” behavior, whereas our κ_{xx} increases monotonously at low temperature (Fig. S13). This discrepancy suggests there is strong thermal phonon scattering in their sample, which may account for the reduced κ_{xy} in KTaO_3 .

Phonon THE has also been observed in many magnetic solids, including cuprates [20], Cu_3TeO_6 [13], $\text{Na}_2\text{Co}_2\text{TeO}_6$ [24], and $\text{Sr}_2\text{Ir}_{1-x}\text{Rh}_x\text{O}_4$ [22]. Note that these materials all exhibit antiferromagnetic orders or short-range magnetic correlations. The intrinsic phonon THE may also be affected by the magnetic environment in these solids. Indeed, as seen in Fig. S12, these materials show similar derivations from the scaling behavior of $|\kappa_{xy}| \sim \kappa_{xx}^2$. In ferromagnetic insulators such as $\text{Lu}_2\text{V}_2\text{O}_7$ [5], $\text{Fe}_2\text{Mo}_3\text{O}_8$ [12], VI_3 [7], and CrI_3 [26], the field-dependent κ_{xy} tracks the magnetization curve and saturates right above the ferromagnetic coercive field. Although the initial study attributed it to magnons [5], subsequent reports have also considered phonon contributions [7,12,26]. Now based on the universal phonon THE, we propose that a more unified perspective is to consider that the spin polarization significantly affects the phonon κ_{xy} .

Except for phonons and magnons, previous studies have also attributed the thermal Hall effect to more exotic excitations. In the quantum spin-liquid candidate $\alpha\text{-RuCl}_3$, a half integer quantized THE has been reported with tilted or planar magnetic field, which was argued as evidence for the existence of Majorana fermions [9,16]. However, this half integer quantized THE has not been reproduced by other research groups [52]. Based on current work, we know that there must exist an intrinsic phonon THE in $\alpha\text{-RuCl}_3$, as reported in Ref. [23] in a completely conventional configuration. Importantly, our results in SrTiO_3 and SiO_2 samples also show that the planar THE could purely come from phonons. These observations strongly warrant a reconsideration of the κ_{xy} observed in $\alpha\text{-RuCl}_3$.