Nuclear Relaxations of Type-II Dirac Electronic System Ni_xTe_2 (x = 1.17)

S. Fujiyama[1], M. Nishino[2], S. Miyasaka[2], R. Kato[1], and S. Tajima[2]

[1]Condensed Molecular Materials Laboratory, RIKEN

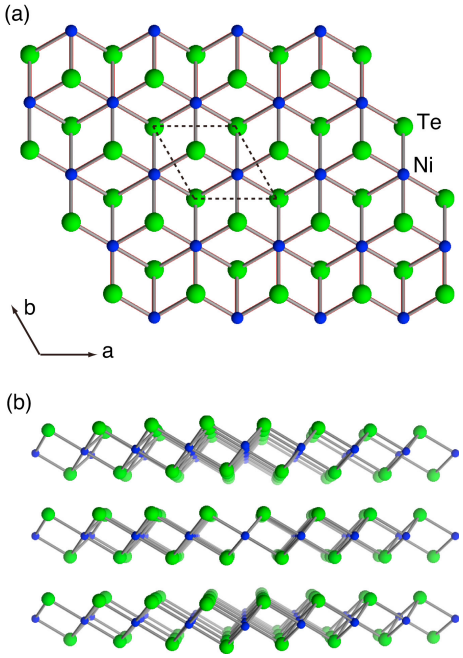
[2]Department of Physics, Osaka University

Dirac electronic systems attract much attention in condensed matter physics. Most of the experimental studies in this field focus on one-body properties of electrons measured by photoemission spectroscopy or transport measurements.

Recently, transition-metal dichalcogenides are recognized to have Dirac-type band structures. Though the Dirac crossing points are located below the Fermi level, anomalously large magnetoresistance up to 2000 % are found in $PtTe_2$.

In the series of transition-metal dichalcogenides, $NiTe_2$ is calculated to be a Dirac system of which crossing point of dispersions is comparatively close to the Fermi level. Moreover, it is found that excess Ni doping to the stoichiometric sample shifts the crossing points at the Fermi level.

We performed ^{125}Te NMR of Ni_xTe_2 (x = 1.17) using a single crystal. The Knight shift is large with a value of 0.8 % caused by strong spin-orbit coupling and independent of temperature, which is consistent with the susceptibility measurements.

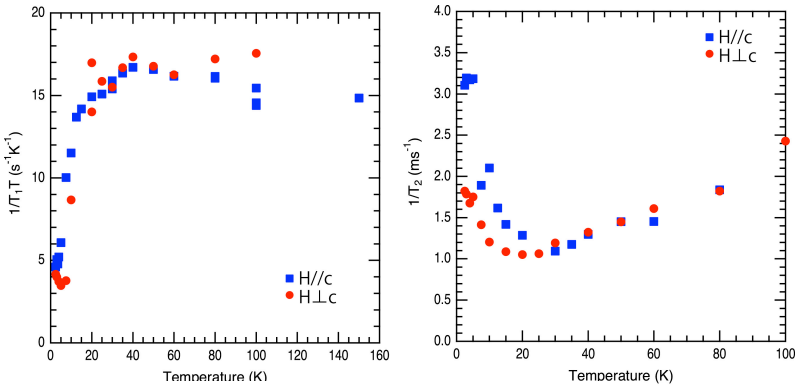


Crystal structure of $NiTe_2$

The $1/T_1T$ that solely reflects the density of states at the Fermi level is independent of temperature above 50 K, however, is strongly suppressed upon cooling. The $1/T_1T$ does not follow an activation formula but follows a power relation to temperature, which is consistent with the linear dispersion relation at the Fermi level.

The nuclear decay curves can be fitted by a Lorentzian formula and $1/T_{2L}$ decreases from 100 K to 20 K that is again consistent with the picture of Dirac electrons. However, $1/T_{2L}$ is unexpectedly enhanced below 20 K. This enhancement depends on the direction of external fields against the crystalline axis.

In electronic materials, we can assume the electronic correlation is nearly isotropic for the whole temperature range. Our observations of a coexistence of the suppressed $1/T_1T$ and the enhanced $1/T_{2L}$ apparently suggest unconventional electronic correlation in this Dirac electronic system.



$1/T_1T$ and $1/T_{2L}$ of Ni_xTe_2 (x=1.17)