

Division of Mathematical and Physical Sciences	Research field	Low Temperature Physics	Lab. ID MP06
Laboratory web site	http://ltphys.w3.kanazawa-u.ac.jp/UltraLowTempLab/		
Research subjects			
<p>Macroscopic quantum phenomena such as superfluidity and superconductivity occur at low temperatures because of small thermal fluctuation. Our low temperature physics laboratory studies superfluidity of ^3He, quantum transition and criticality of heavy Fermion compounds, nuclear magnetism of rare earth Pr compounds, and so on by means of ^3He-^4He dilution refrigerator and Cu single stage nuclear demagnetization refrigerator in micro Kelvin temperatures. Experiments in such low temperatures are worked at limited laboratories in the world.</p> <p>In milli-Kelvin temperature range, we also study quantum fluid and solid, ^4He superfluidity in porous materials, quantum transition from the experiments of specific heat, magnetic susceptibility, thermal expansion, magnetostriction, and acoustic properties using dilution refrigerator, ^3He cryostat and cryostat with 15 T superconducting magnet.</p> <p>Magnetic refrigeration that makes use of magneto caloric effect is studied from 1 K to room temperature. We have both magnetic materials and refrigeration system of magnetic refrigeration.</p>			
Master/Doctor course: Education policy, curriculum, typical activity in the laboratory			
<p>Professor Matsumoto and Professor Abe are conducting several experimental groups as main staff. Each group is consists of graduate couse students and under graduate students, because long period experiments in low temperature need team work. Newcomers will choose research subject on the basis of his interest and belong to an experimental group. We have close discussions between faculty staff and students and conference meeting on all the groups so that experimental results and plans are discussed. Seminar be students and article reading are also carried.</p> <p>Outcomes are presented at academic meeting and published as journal paper.</p>			
Daily life in the laboratory, etc.			
<p>Our experimental apparatus are mainly installed in Kanazawa University low temperature laboratory. Low temperature experiments become long period experiments so that it will last late at night and sometimes need machine check in holidays. Then, experiments are carried out in collaboration with group members and faculty staff. It is necessary to construct original experimental setup, cell, measuring system or both because commercial machines don't have enough performance. Sometimes improvements of commercial machines are required. Technical skill such as machine, electronic work will be necessary to learn.</p> <p>Researchers and students from foreign countries visit our laboratory. Our low temperature laboratory has collaboration with Kazan Federal University in Russia. Students visited between Russia and Japan.</p> <p>We have parties and BBQ for recreation.</p>			
Message or comments by the laboratory faculty staffs			
<p>Cooperative personality will be necessary because of group experiments. We believe that faculty staff and students are equal as researcher. We hope every student has his own idea and aggressiveness enough to make forward his research and academic interest in other research groups.</p> <p>Alumnus have jobs in various fields, such as academic post, postdoc researcher, high school teacher, researcher in private companies.</p>			
Recent Master theses in these 3 years (+ more if appropriate)			
year.month	Thesis title (including English translation of Japanese thesis title)		
2017.3	Magnetic and thermal properties of magnetic refrigerant EuS		
2017.3	Thermal expansion and magnetostriction of $\text{Pr}_3\text{Pd}_{20}\text{Ge}_6$ in low temperature and high magnetic field		
2017.3	Thermal expansion and magnetostriction measurements of heavy Fermion compounds at ultralow temperatures in high magnetic fields		
2016.3	Study on superfluid helium in aerogel using quartz tuning fork and heat pulse		
2016.3	Study of physical property on room temperature magnetic refrigeration material hydrogenated $\text{La}(\text{Fe}_{0.88}\text{Si}_{0.12})_{13}$		
2016.3	Studies on thermal expansion and magnetostriction of clathrate compounds $R_3\text{Pd}_{20}\text{Ge}_6$ ($R = \text{La}, \text{Pr}$)		
2015.3	Quantum criticality of heavy fermion system at ultra low temperatures by thermal expansion and magnetostriction measurements		
2015.3	Magnetocaloric Effect and thermal conductivity of magnetic materials for magnetic refrigeration		
2015.3	Experimental study on superfluidity of ^4He by means of tuning fork quartz crystal and heat pulse		
2014.3	Dilatometric measurements of heavy fermion compound CeRu_2Si_2 at low temperatures in high magnetic		
2014.3	Study on thermal expansion and magnetostriction of magnetic materials for magnetic refrigeration using capacitive dilatometer		
2014.3	Ultrasound experiment on vacancy in Si single crystal at ultra low temperatures		
2014.3	Experimental study on superfluidity of ^4He in Aerogel by means of heat pulse		
2013.3	Thermal expansion and magnetostriction of heavy fermion compound CeRu_2Si_2 at millikelvin temperatures in high magnetic fields		
2013.3	Magnetic propertires of $\text{Pr}_3\text{Pd}_{20}\text{Ge}_6$ at low temperatures		
2013.3	Magnetocaloric effect of $\text{La}(\text{Fe}_x\text{Si}_{1-x})_{13}$		
Recent Doctoral theses in these 3 years (+ more if appropriate)			

year.month	Thesis title (including English translation of Japanese thesis title)
2016.3	Thermal expansion and magnetostriction measurements of heavy fermion CeRu ₂ Si ₂ at ultralow temperatures and high magnetic fields
2016.3	Magnetic and quadrupolar ordering of Pr ₃ Pd ₂₀ Ge ₆
2009.3	Quantum criticality in heavy fermion CeRu ₂ Si ₂ near absolute zero tempertaure
Laboratory mail address	Koichi Matsumoto <kmatsu *at* staff.kanazawa-u.ac.jp> Satochi Abe <abesi *at* staff.kanazawa-u.ac.jp>