

Novel states of matter induced by frustration !

anomalous order(disorder) and fluctuations

Kadono, Nohara (itinerant frustrated systems)

Fujita (exotic excitations in spinel)

Hiroi (quantum spin liquid in kagome magnet)

Monbukagakaku-syo project

Grant-in-Aid for Scientific Research
on Priority Areas

2007-2011



Grant-in-Aid for Scientific research on Priority Areas

A01 Fundamental Properties of Frustrated Systems

1. Novel Order in Geometrically Frustrated magnet

2. Frustration and Chirality

3. Quantum Frustration

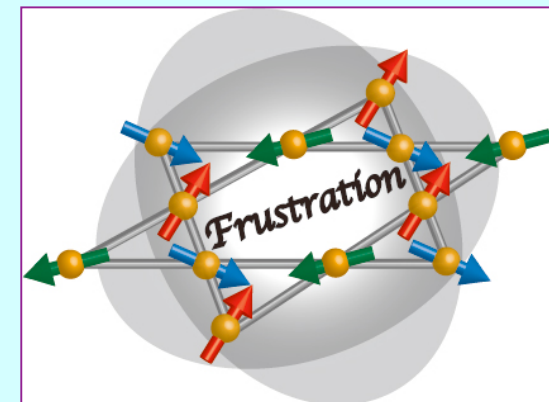
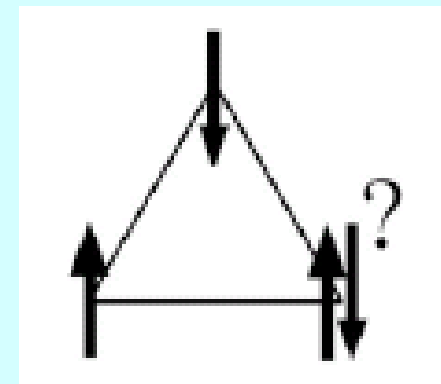
A02 Frustration-induced Novel Phenomena and their Applications

4. Frustration and Quantum Transport

5. Frustration and Multiferroics

6. Frustration and Relaxor

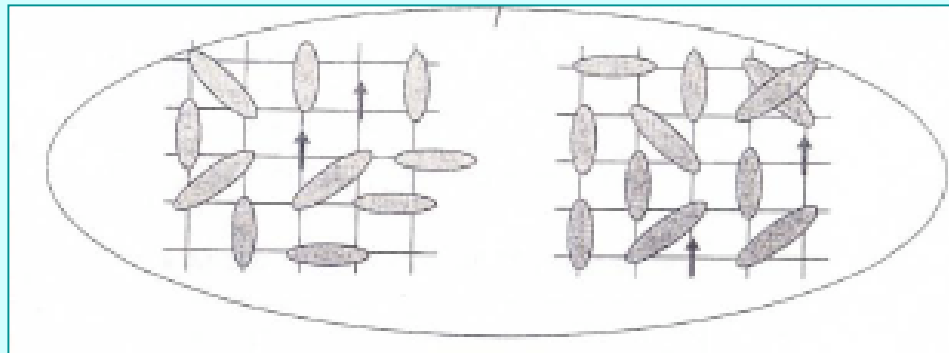
7. Geometrical frustration and functions in spin-charge-lattice coupled system



Quantum spin liquid

--- possible new disordered state of matter

e.g., **RVB state** [P.W.Anderson]

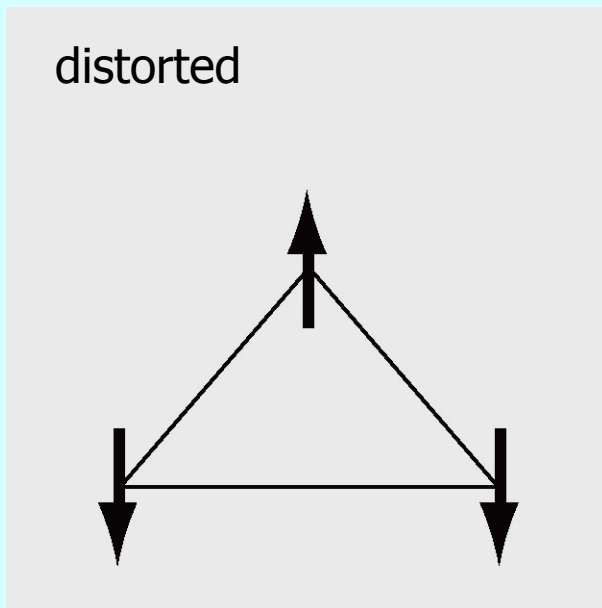


“spinon”

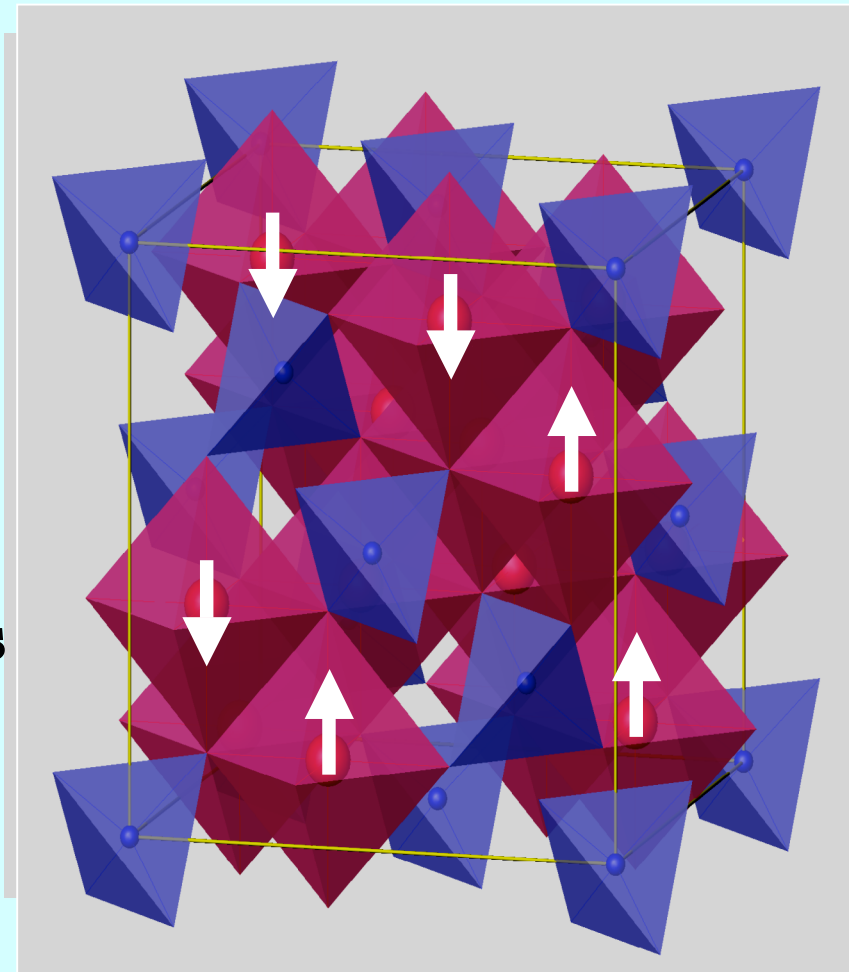
- * gapless vs. gapped (**Hiroi,Kato**)
- * novel excitations (**Fujita**)
- * doping might lead to a novel metallic state ? (**Nohara**)

Coupling to other degrees of freedom

--- lattice, charge and orbitals



Spinel compound: CdCr_2O_4



Coupling to dielectric properties
multiferroics (**Arima**)

Coupling to orbitals (**Nohara**)
orbital spin liquid ?

Itinerant frustrated system

--- possible new transport properties

Itinerant electrons on frustrated lattices

- * Strongly correlated electrons with AF spin correlations are subject to frustration
- * Flat-band effect

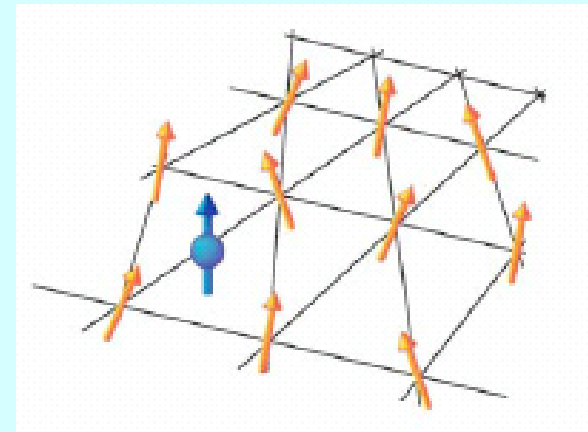


Heavy mass (Kadono)

New superconductivity ?

Novel electronic excitations ?

Unconventional anomalous Hall effect due to
the spin chirality



We need powerful tools and probes to “reveal” new state of matter !

Synthesis of new materials and samples

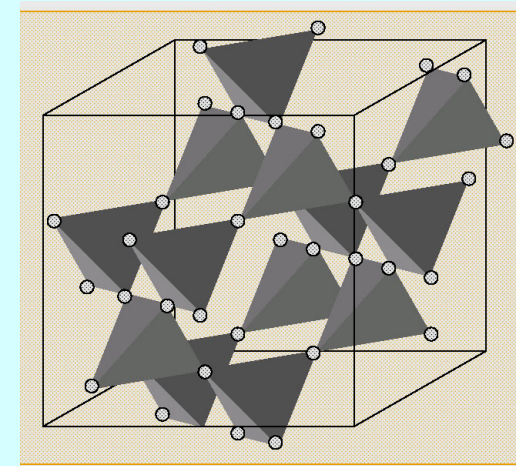
Magnetic measurements

Thermal measurements

Transport measurements

NMR, ESR

Muons, X-ray(SR), neutrons



Valuable beam !

High expectation to IMSS

Theory, numerical simulations