

Emergent Phases in Quantum Magnets

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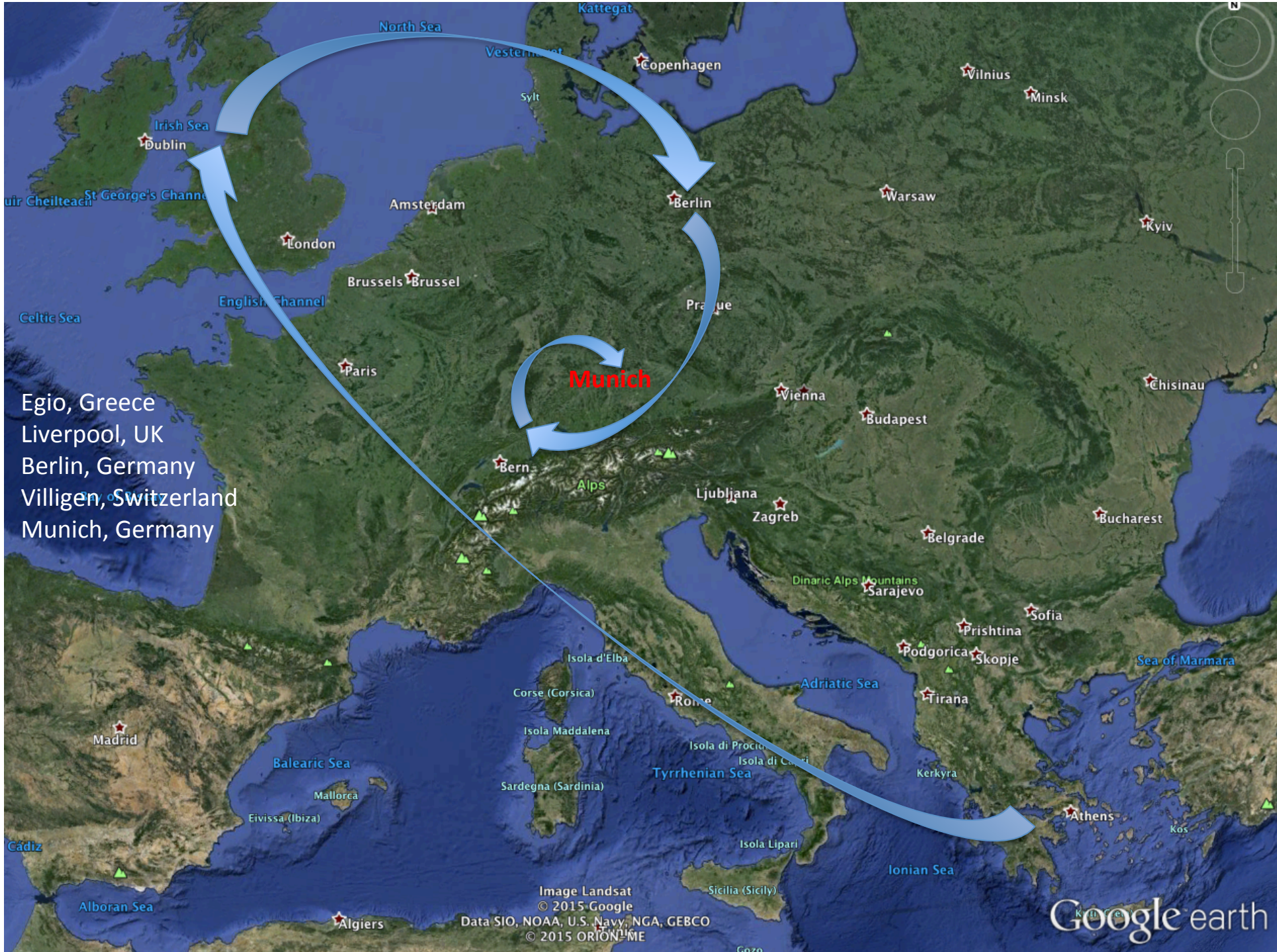
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F2
TRR80 Graduate School

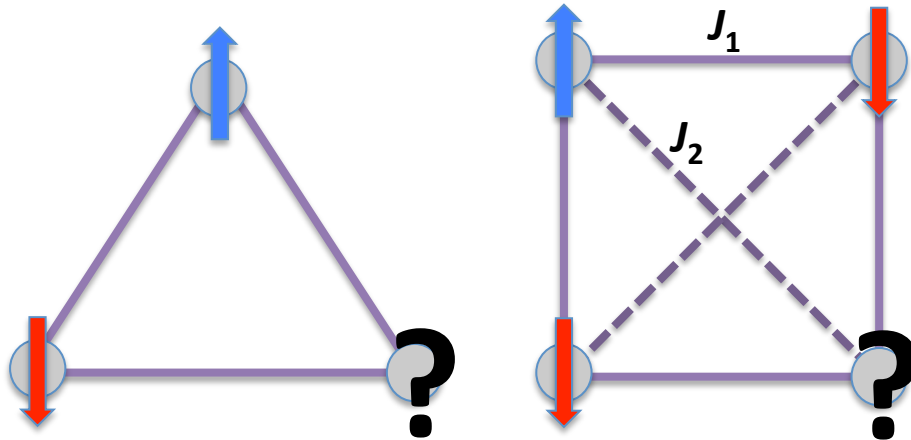


TRR 80



Egio, Greece
Liverpool, UK
Berlin, Germany
Villigen, Switzerland
Munich, Germany

2D Frustrated Ferromagnets

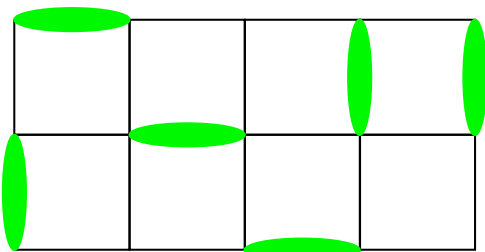


- Deceivingly simple system, J_1 - J_2
- Rich phase diagram
- First ever realisations of mixed J_1 - J_2 square lattice systems
- Spin correlations

Hunting for spin liquid and spin nematic phases (no LRO)

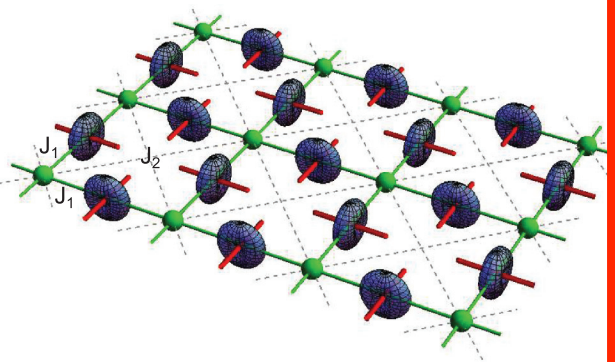
Singlets ($S=0$)

$$\frac{1}{\sqrt{2}} \left| \begin{array}{c} \uparrow\uparrow \\ \downarrow\downarrow \end{array} \right\rangle = \text{green oval}$$

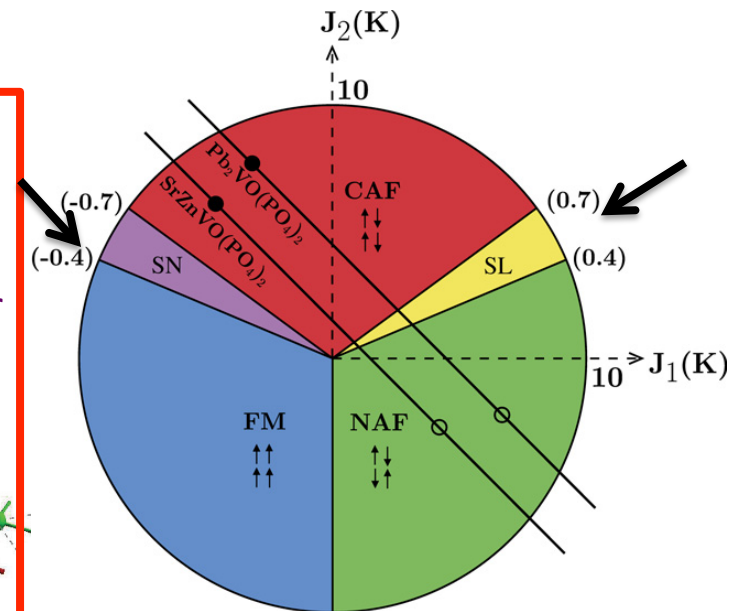


P.W. Anderson RVB

Spins form triplets ($S=1$)
Quadrupolar order parameter



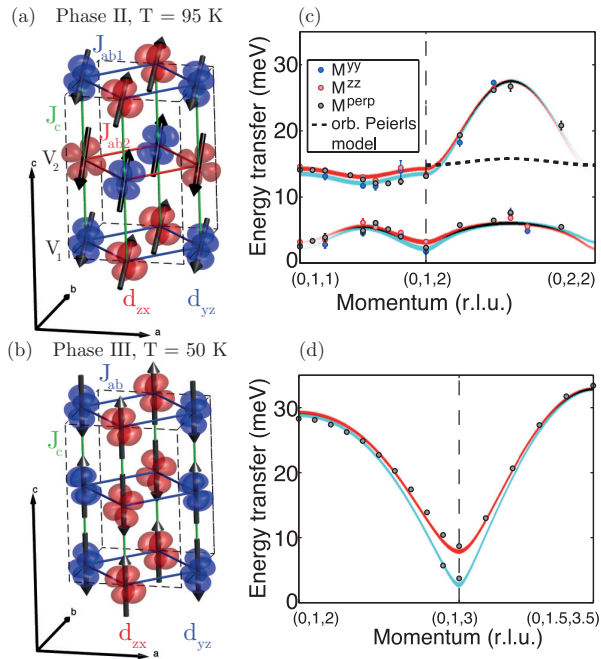
Overcome frustration



M. Skoulatos et al., Europhysics Letters **88**, 57005 (2009)

Spin and Orbital Arrangements

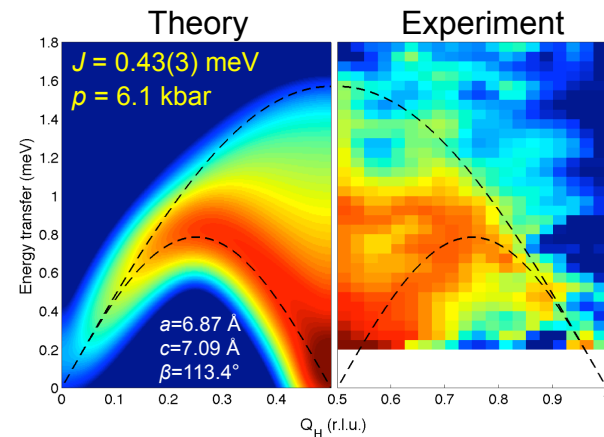
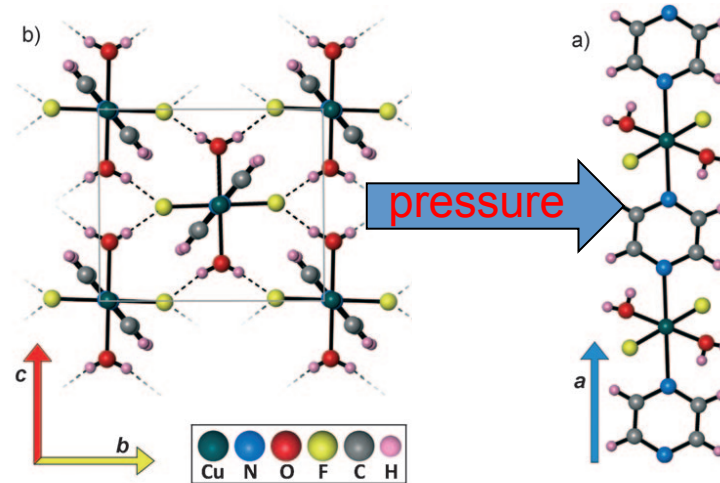
LuVO₃ recent results:



- Inelastic neutron scattering
- Resonant x-ray scattering
- Spin-orbital ground state
- Spin-orbital excitations
- Classical vs. quantum behaviour of orbitals

M. Skoulatos et al., PRB Rapid Comm. **91**, 161104(R) 2015

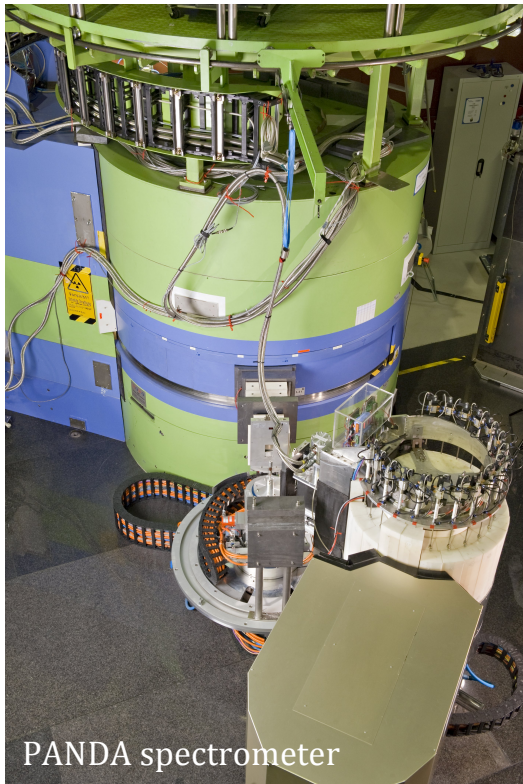
Metal-organic structures, future projects:



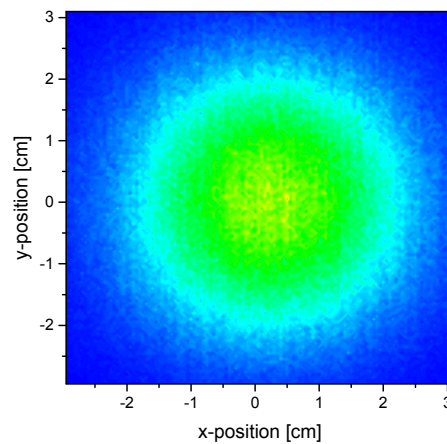
- Magnetic coordination materials, Jahn-Teller axis
- Pressure-induced dimensionality change
- From spin waves to spinons, within the same system!

Instrumentation

Focus the beam of the triple axis spectrometer PANDA down to a spot-size suitable for small samples/pressure cells

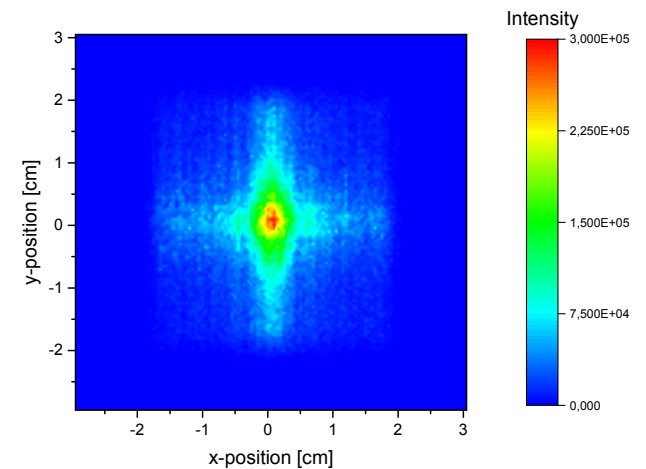


Monochromator focussing



Monochromator spot size:
 $3.4 \times 3.4 \text{ cm}^2$

Neutron guide focussing



Elliptical guide spot size:
 $0.7 \times 1.1 \text{ cm}^2$

Christoph Utschick (Bachelor thesis)

Thank you!