

# ATOMS AND LIGHT IN DENSE OR COMPLEX MEDIA

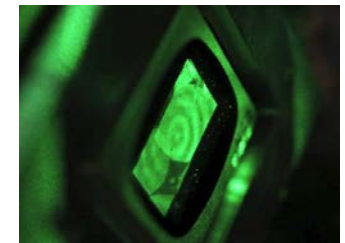
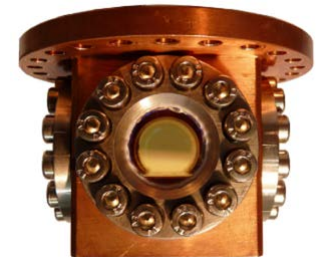
**Experimental and theoretical research.**

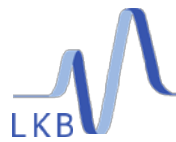
**Two teams:**

- **Polarised helium, quantum solids and fluids**  
Helium in gas, liquid or solid phases (as topic or model system), using optical or NMR techniques
- **Optical imaging in biological and complex media**  
Coherent effects, propagation and control of light in disordered systems

**+ Interface with biology or medicine**

*A common interest and concern of both research teams*





## **Polarised helium, quantum solids and fluids**

### **Experiments and simulations**

- **Helium** in gas, liquid or solid phases
- optical spectroscopy or NMR/MRI

### **Theory:**

Fundamental  
quantum mechanics

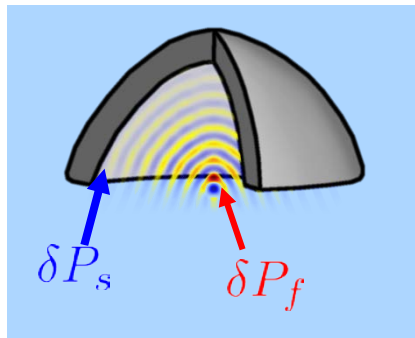




Jules GRUCKER

## Quantum liquid and solid $^4\text{He}$

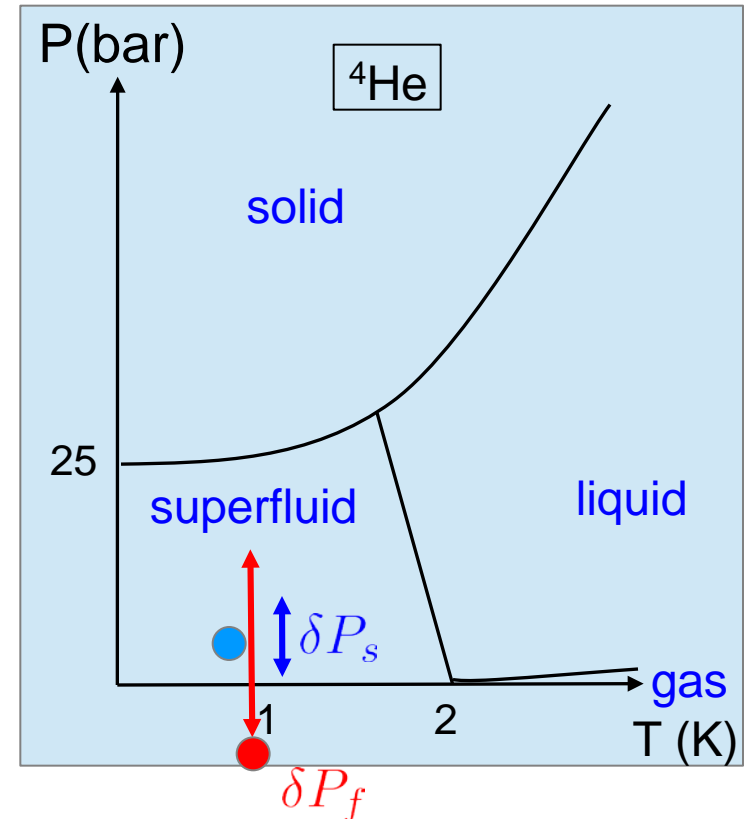
Research on metastable phases of condensed helium



Driving: **focused acoustic wave**

Observation: **imaging/interferometry with pulsed (ns) laser light**

**Current project** (L.Djadojee): *stimulated Brillouin scattering in  $L^4\text{He}$*



## Polarising / using polarised $^3\text{He}$



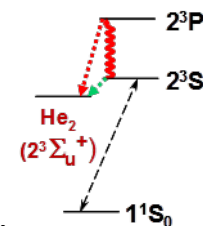
P.-J. NACHER



G. TASTEVIN

### Physics of optical pumping in exotic conditions

- Investigations on **angular momentum loss** in He plasmas (A. Dia)
  - OP studies continued at high field (7 T) and extended to low T (4 K)
- Application: **Zeeman magnetometry** ( $\delta B/B \approx 10^{-12}$ )



*WideNMR project, Saclay (DIM Analytics)*

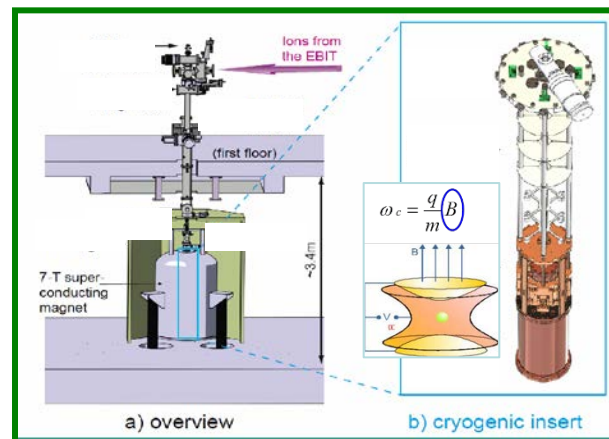


NMR cryostat  
2.7 to 400 K

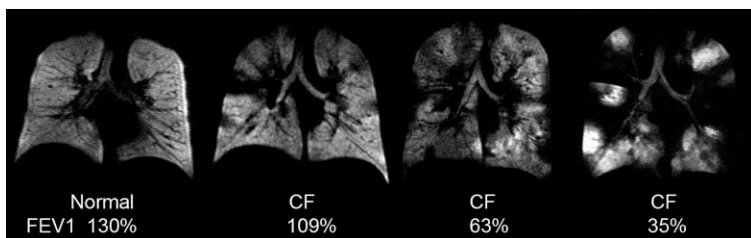


*Collab. with Mainz U.*

PENTATRAP  
experiment,  
mass measurement  
of cold ions



## Low-field NMR and MRI

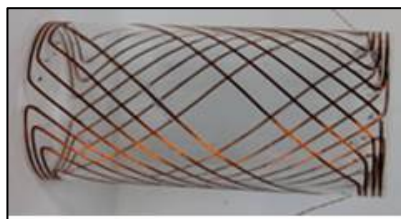


*Acad. Radiol.* **12**, (2005) 1423, K. Mentore, et al.

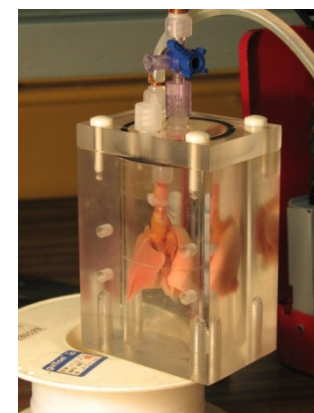
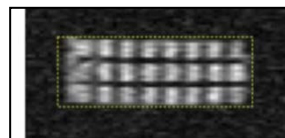
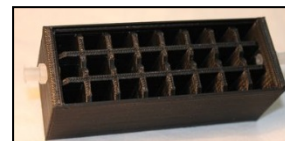
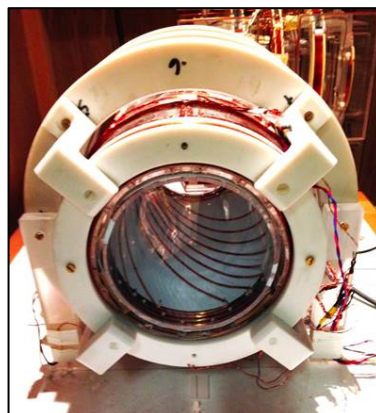
From gas MRI in lungs...

...to the **development of innovative low-B methods**

**TRASE**  
Gradient-free  
NMR imaging



**MARGIN**  
<sup>3</sup>He gas diff. in  
nanoporous  
materials



*Thermally polarised water or Laser-polarised <sup>3</sup>He gas*