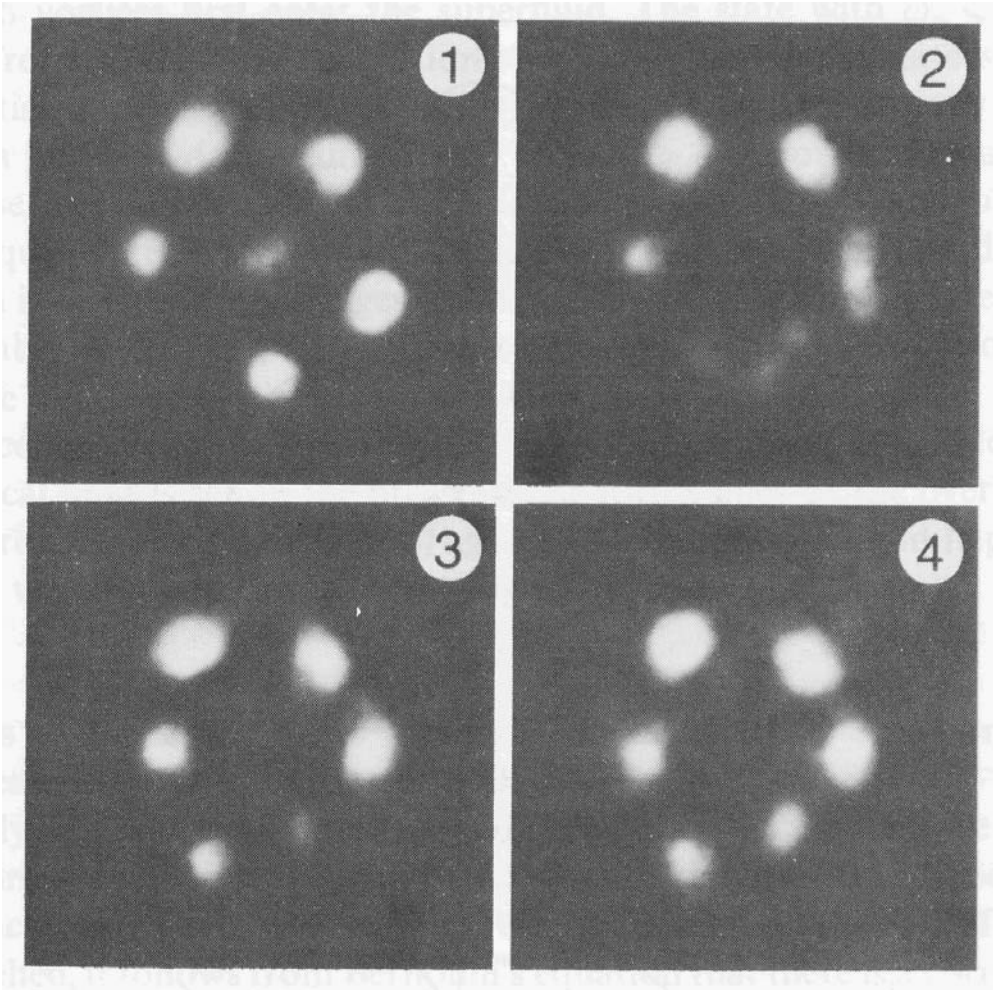
低温物理学

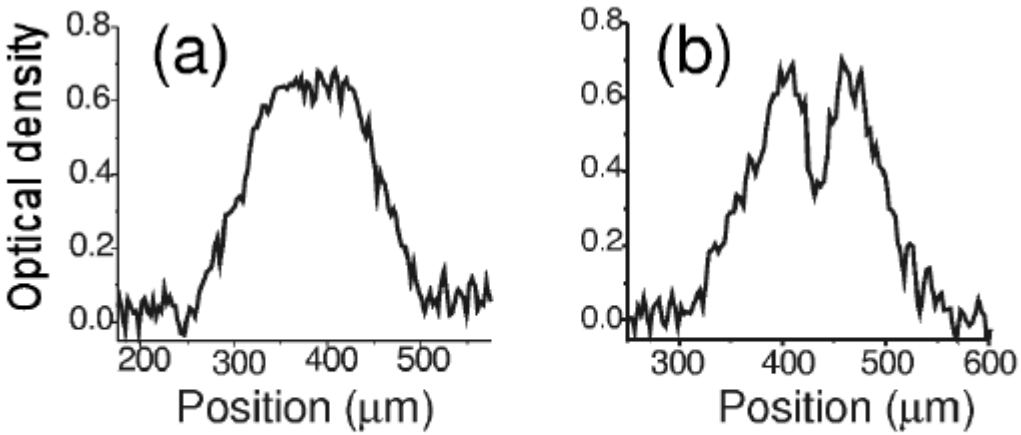
第3回 2009年4月23日

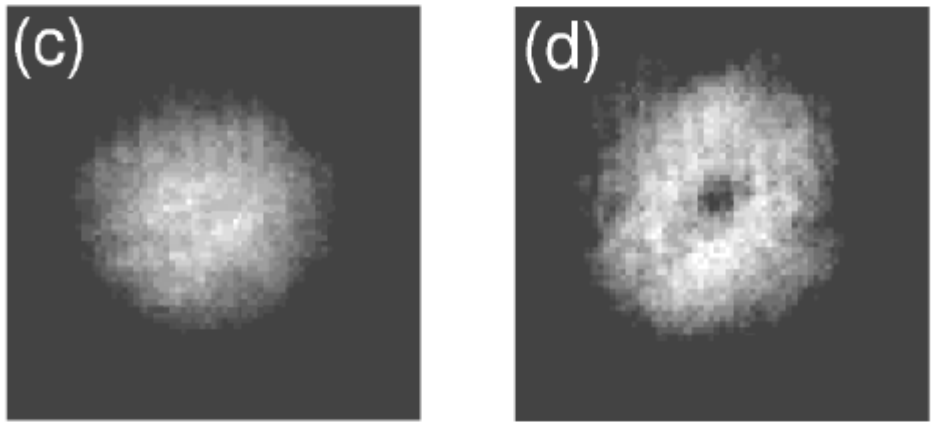
勝本信吾

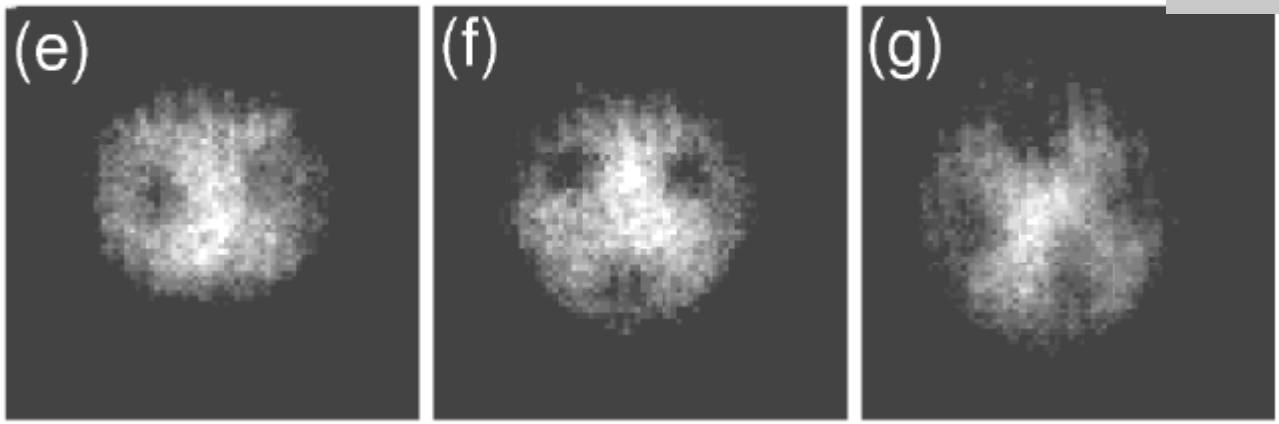
バケツ中のヘリウムの量子渦糸



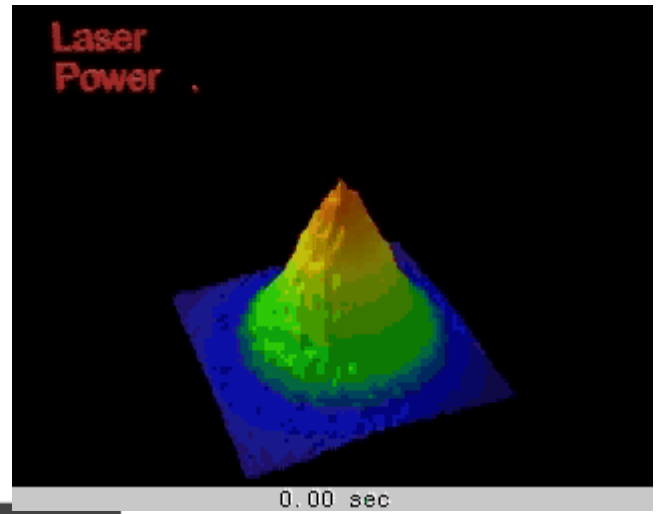
quantized vortices in BEC

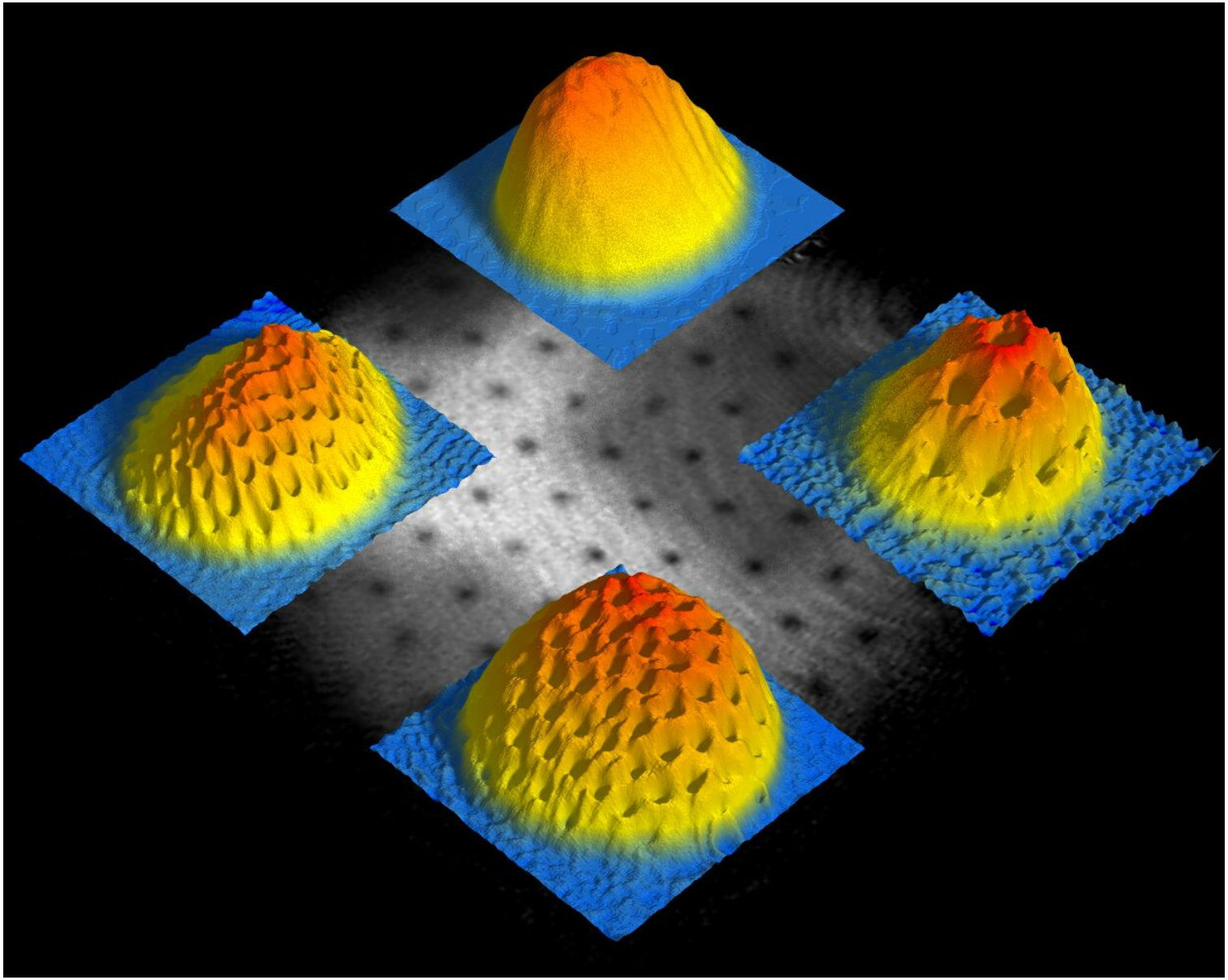




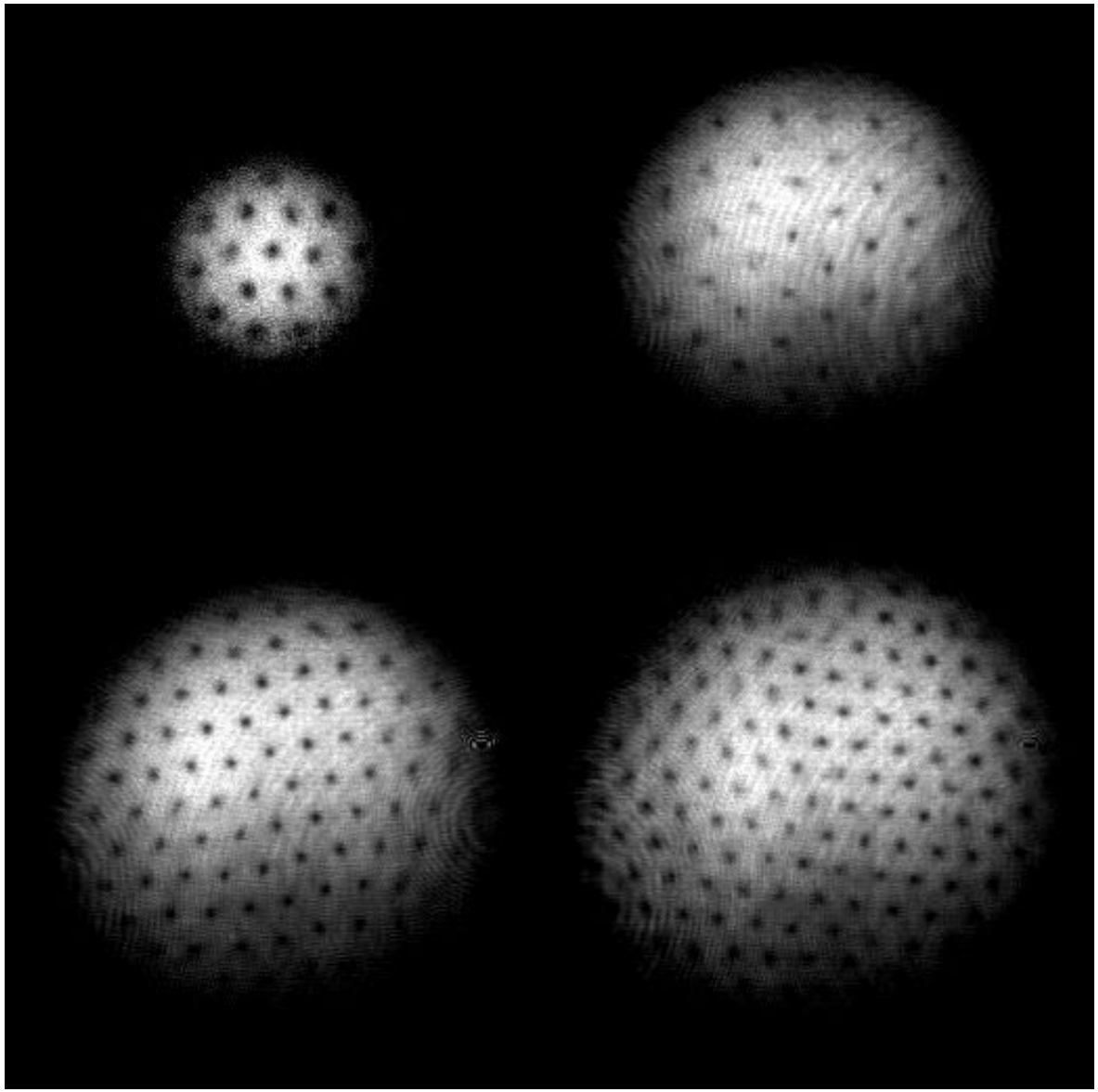


K. W. Madison et al.
PRL 58, 806 (2000).

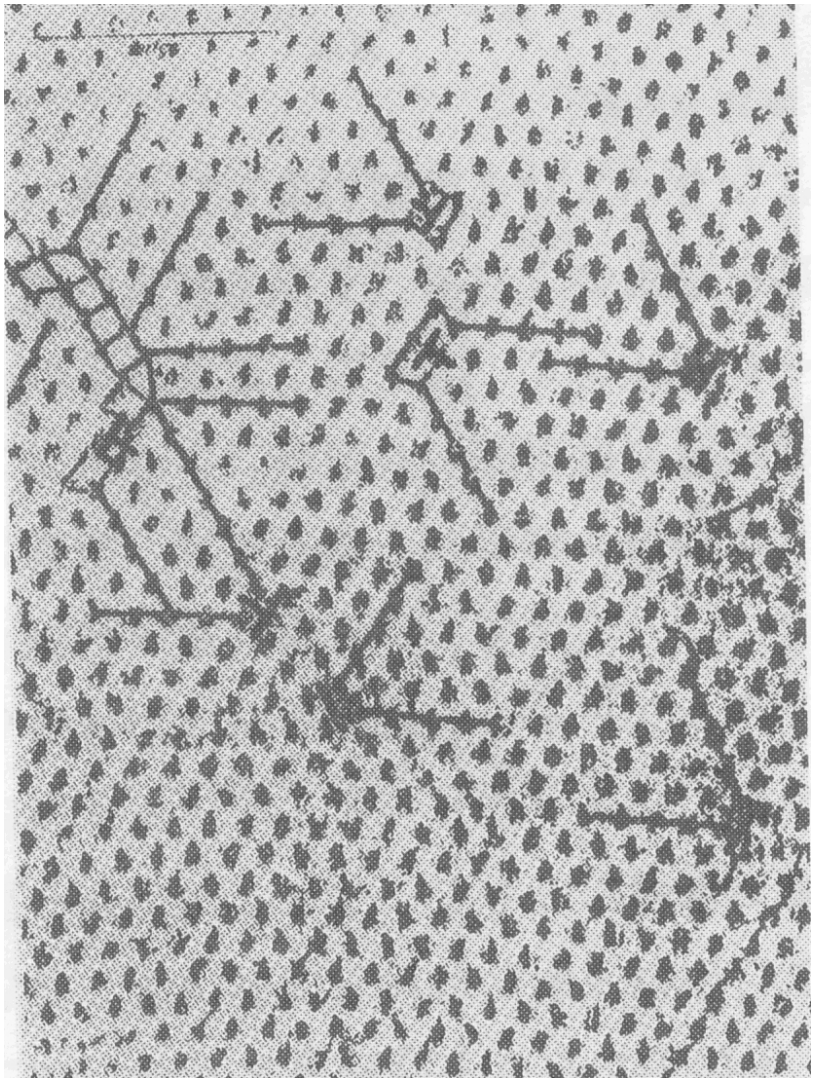


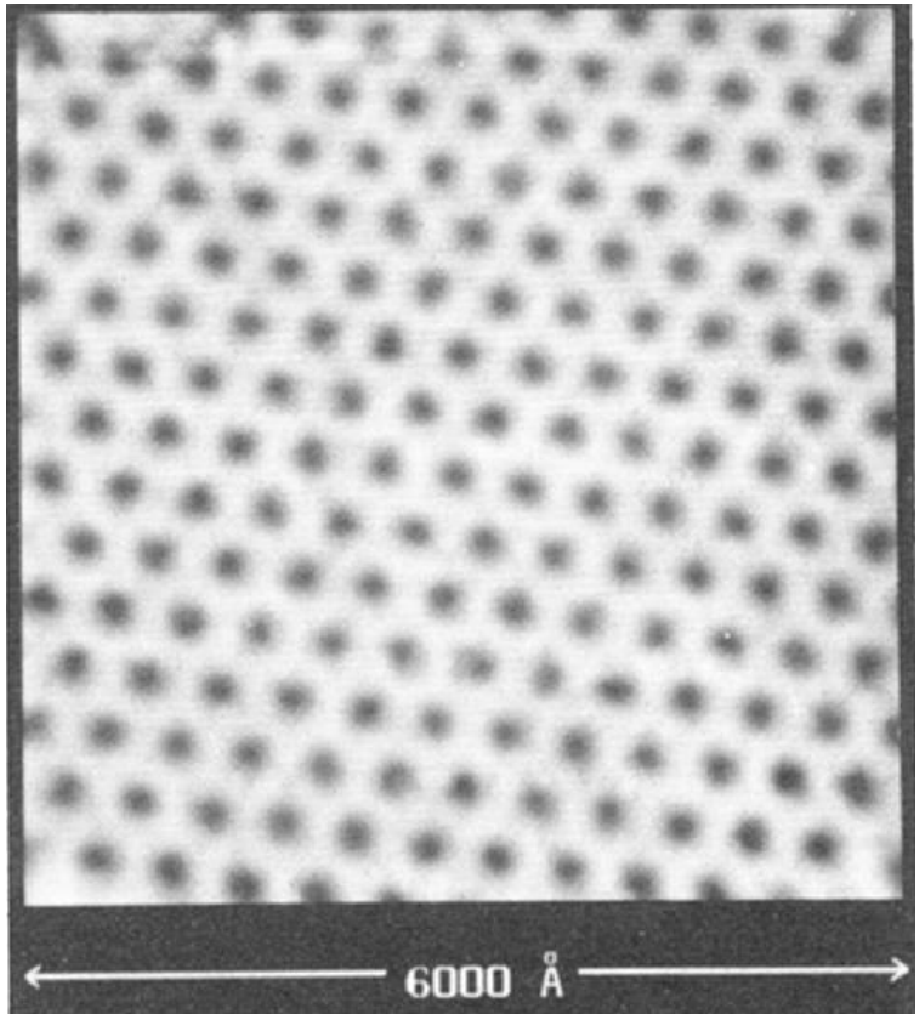


BECのアブリコソフ格子



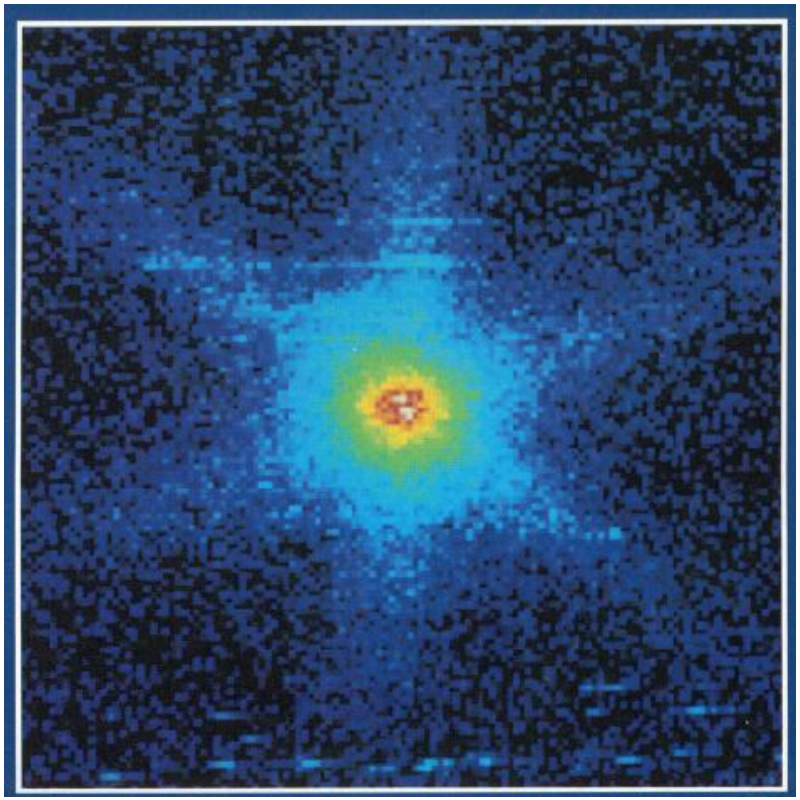
超伝導体のAbrikosov格子

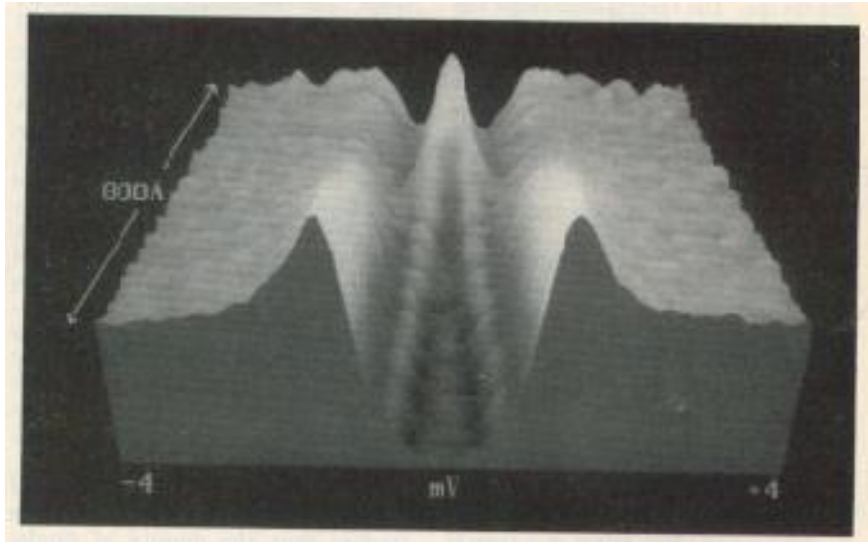


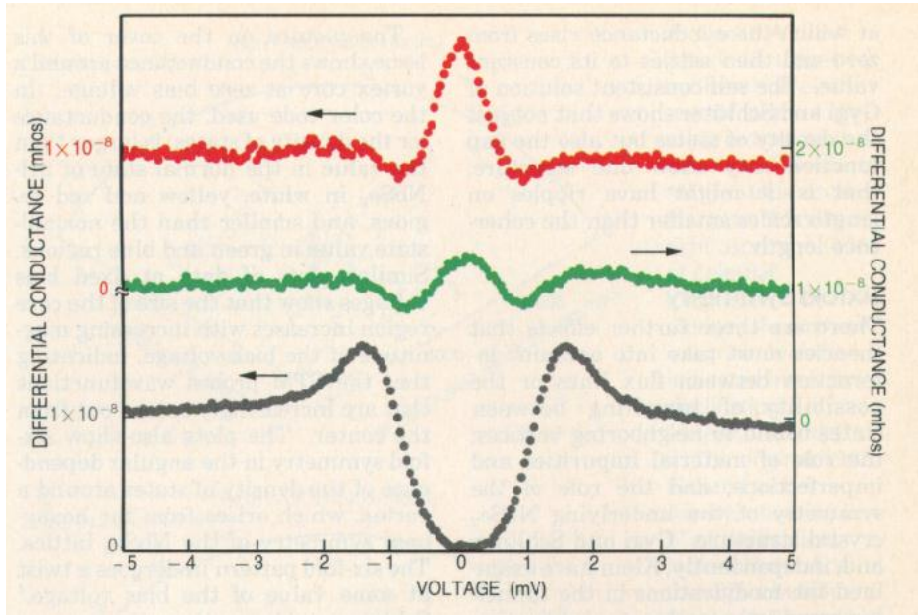


Nb (ビッター法)

Vortexの微細構造

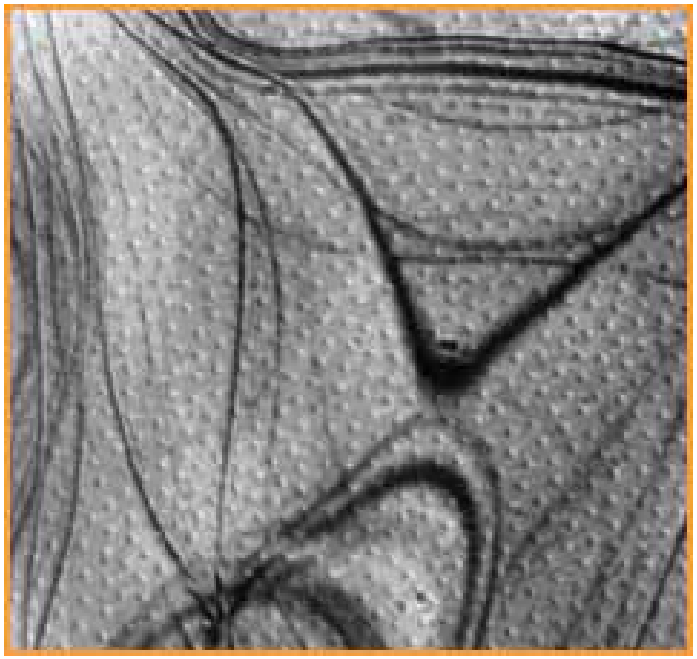






H. F. Hess et al. Phys. Rev. Lett. 62,214 (1989)

Lorentz顕微鏡によるvortex運動の観察

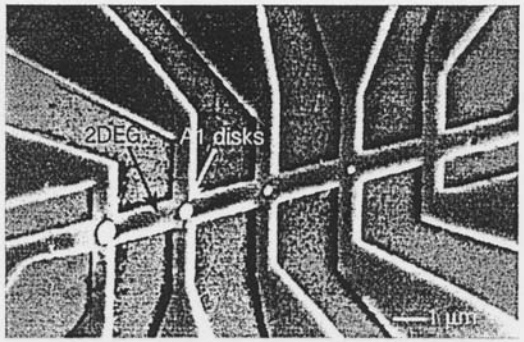


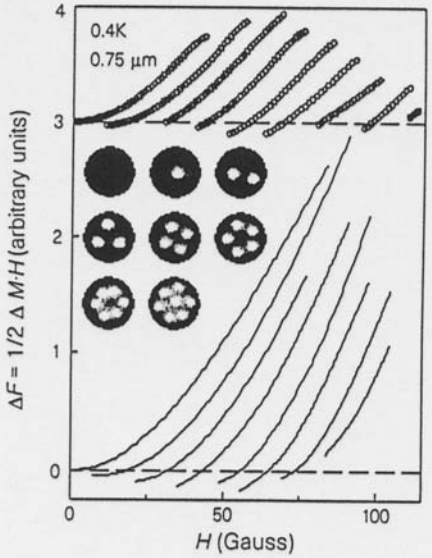
Nb

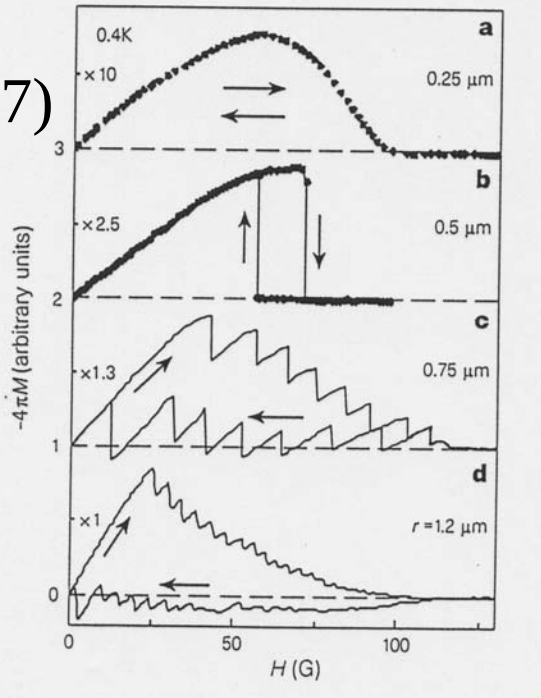
Hitachi
Tonomura
group

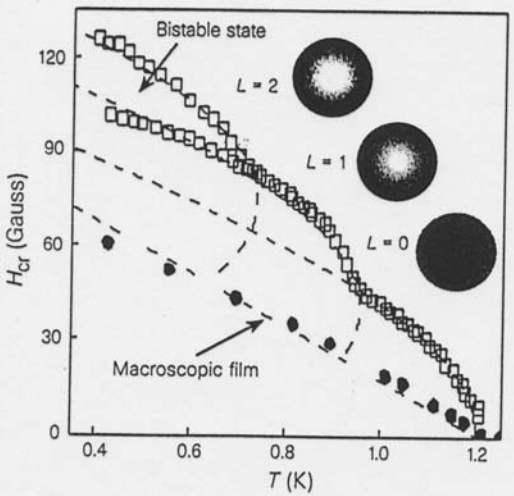
２次元電子系で
渦糸状態を検出

A.K. Geim et al.
Nature **390**, 259 (1997)









巨大渦糸状態のエネルギー（磁場依存性）

Benoist & Zwerger
Z. Pnys. **B103**, 377 (1997)

Linearized GL equation

$$-\frac{\hbar^2}{4m}\left(\nabla-\frac{2ie}{\hbar}\boldsymbol{A}\right)^2\psi=-\alpha\psi$$

境界条件　：　$$\boldsymbol{n}\cdot\left(\nabla-\frac{2ie}{\hbar}\boldsymbol{A}\right)\psi\Big|_{\partial V}=0$$

$$\psi=\mathcal{R}(\rho)e^{im\phi}e^{ik_\nu z},\quad k_\nu=\nu\pi/d$$

$\zeta\equiv\rho^2/2l_B$，$l_B=\sqrt{\hbar/2eB}$ として

$$\mathcal{R}(\zeta)=e^{-\zeta/2}\zeta^{|m|/2}w(\zeta)$$

で w を定義すると

$$\zeta\frac{\partial^2 w}{\partial\zeta^2}+(|m|+1-\zeta)\frac{\partial w}{\partial\zeta}-\alpha w=0$$