Density Profiles of Trapped Polarized Fermi Gases
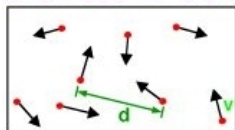
Gianluca Bertaina

Università di Trento and INFM CNR-BEC Center
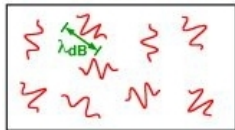
Physics PhD Workshop 2008, Trento, December 5th
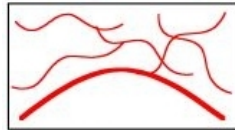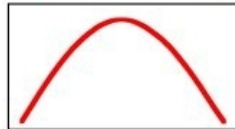
What is Bose Einstein Condensation?
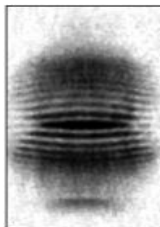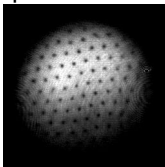
Images from MIT webpage

What is done in experiments?
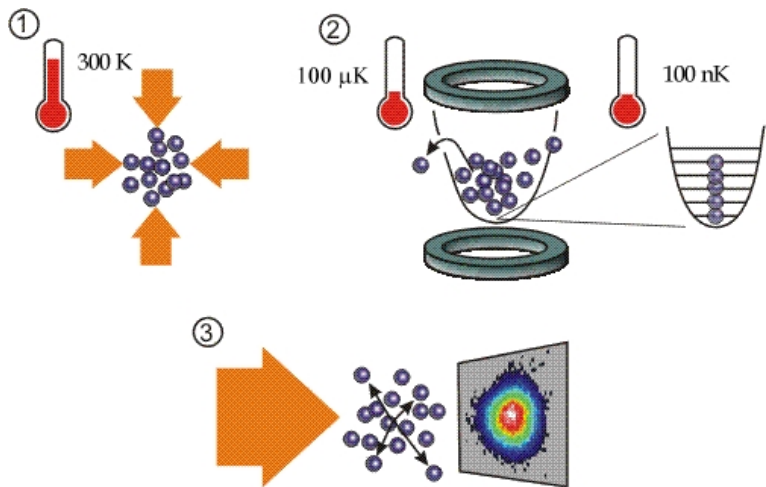
Images from Jila webpage

Quantum Monte Carlo for Ultracold Gases in Trento

Head
Stefano Giorgini

Post-Doc
Sebastiano Pilati

PhD student
Gianluca Bertaina

Current research:
Bosons at $T > 0$, with disorder (Path Integral Monte Carlo)
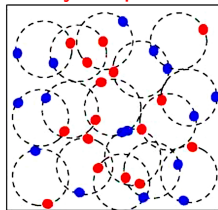Fermions at $T = 0$, in $3D$ and $2D$ (Diffusion Monte Carlo)

Collaborations:

Theory:	UPC (Barcelona), Astrakharchik, Boronat, Casulleras
	UMass (Amherst), Prokof'ev
Exp:	Ecole Normale (Paris), Dalibard
	IQOQI (Innsbruck), Grimm
	MIT (Boston), Ketterle

Change interaction at $P = 0$:
Always superfluid

Fermionic superfluid (BCS)   Bosonic superfluid (BEC)
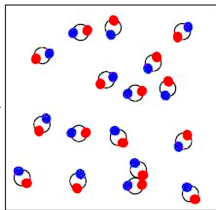
BCS-BEC crossover

Change spin polarization $P > 0$
From normal gas to superfluid

Quantum phase transition
Chandrasekhar-Clogston
limit

Homogeneous system: DMC calculations (*Pilati, Giorgini*)
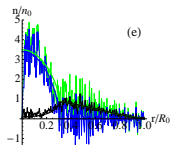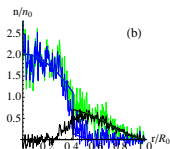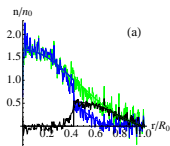
Density Profiles of the (3D) Trapped Gas

Interaction
Polarization

Radial Density

Column Density

$\frac{1}{k_F^0 a} = 0$
$P = 0.43$
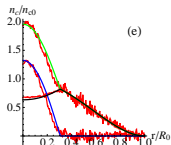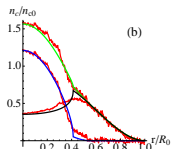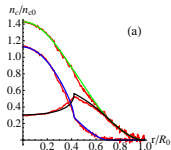
$\frac{1}{k_F^0 a} = 0.35$
$P = 0.52$

$\frac{1}{k_F^0 a} = 1.59$
$P = 0.73$

Local Density
Approximation

Minimize
Grandcanonical
potential

Spin up
Spin down
Difference