**Metastable Bose-Einstein condensates**

During the studies of the spinor ground states we encountered two different types of metastability which we investigated in more detail [1]. In one case, a two-component condensate in the $m_F=+1$, 0 hyperfine states was stable in spin composition, but spontaneously formed a metastable spatial arrangement of spin domains. In the other, a single component $m_F=0$ condensate was metastable in spin composition with respect to the development of $m_F=+1$, -1 ground-state spin domains. In both cases, the energy barriers which caused the metastability were much smaller than the temperature of the gas (as low as 0.1 nK compared to 100 nK) which would suggest a rapid thermal relaxation. However, since the thermal energy is only available to non-condensed atoms, this thermal relaxation was slowed considerably due to the high condensate fraction and the extreme diluteness of the non-condensed cloud.

When a condensate was initially prepared in a pure $m_F=0$ state metastability of up to 5 sec was observed for the formation of the equilibrium spin domain structure (see figure). In contrast when the system was prepared in an equal mixture of $m_F=+1$ and $m_F=-1$ atoms the fraction of atoms in the $m_F=0$ state grew without delay, arriving at equilibrium within just 200 ms.

Metastability of the spatial distribution was observed in a system of $m_F=+1$ and $m_F=0$ atoms. After the $m_F=0$ state was populated with an rf pulse, the system rapidly developed into alternating layers of $m_F=0$ and $m_F=1$ spin domains of about 40 µm in thickness which were metastable for 20 seconds in the absence of magnetic field gradients.

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