For our reserach it is neccessary to have some very slow moving, ultracold atoms. To get atoms cool you use a laser to get "Doppler cooling" and magnetic fields to keep them in position. That is called "Magnetic trapping". This is what we do with a Magneto Optical Trap.

An atom absorbing a photon gets an additionally momentum in the direction of the photon motion. By emitting a photon in a random direction it gets momentum in the opposite direction. If the laser beam is redshifted only atoms moving towards the laser can aborb photons because of the Doppler effect. This technique is called Doppler cooling.

An applied magnetic quadrupole field causes the Zeeman effect on atoms moving away from the centre of the trap. This lowers the energy difference of the m_f-levels and shifts the atomic resonance closer to the beam frequency. Therefore these atoms are more likely to be kicked by photons and will be redirected to the centre. The Zeeman effect can only be used with polarized beams.

To avoid acceleration by impact with other particles the MOT is set in a vacuum.

Sub-Doppler spectroscopy: mirrors:
With a mirror you can redirect a beam of light.
polarized beam splitters:
waveplates:
eom:
aom: