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Observation of Feshbach resonances in an ultracold gas of chromium atoms JUERGEN STUHLER, JOERG WERNER, AXEL GRIESMAIER, SVEN HENSLER, TILMAN PFAU, 5. Physikalisches Institut, Universitaet Stuttgart, 70550 Stuttgart, Germany, ANDREA SIMONI, EITE TIESINGA, National Institute of Standards and Technology, Gaithersburg, Maryland 20899-8423, USA — We have observed Feshbach resonances (FRs) in collisions between ultracold ^{52}Cr atoms by monitoring atom loss from a crossed optical dipole trap as a function of applied magnetic offset fields (0-60 mT). This is the first observation of FRs in an atomic species with more than one valence electron. Chromium has the electronic configuration [Ar]3d^{5}4s^1, which gives rise to its large magnetic moment of 6 Bohr magnetons. The zero nuclear spin of ^{52}Cr leads to regularly-spaced resonance sequences. Comparing the experimental FR positions with multi-channel scattering calculations of A. Simoni and E. Tiesinga (NIST Gaithersburg, USA), we are able to assign all eleven FR that are expected up to second order in the dipole-dipole coupling for the S=6, MS=-6 s-wave entrance channel and to determine the s-wave scattering lengths of the lowest $^{2S+1}\Sigma_g^+$ potentials to be 112(14) a0, 58(6) a0 and -7(20) a0 (a0 = 0.0529 nm) for S = 6, 4, and 2, respectively. Exploiting one of the FRs to tune the isotropic contact interaction in our recently realized Bose-Einstein condensate (BEC) of ^{52}Cr should allow us to create a dipolar BEC in which the anisotropic (magnetic) dipole-dipole interaction is dominant.

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