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Measurement of the magnetic interaction between two electrons SHLOMI KOTLER[1], NITZAN AKERMAN, NIR NAVON[2], YINNON GLICKMAN, ROEE OZERI, Weizmann Institute of Science — In this talk we will report on the first measurement of the magnetic interaction between two electronic spins. While the dipolar magnetic interactions between different spin systems, such as an electron and its nucleus or several multi-electron spin complexes, were experimentally studied, the magnetic interaction between two isolated electronic spins was never observed. We will explain why columb exchange forces on the one hand, and magnetic field noise on the other hand, make the electron-electron magnetic interaction measurement a challenging one. This challenge was resolved by the use of Quantum Information techniques. In our experiment, we used the ground state valence electrons of two $^{88}Sr^{+}$ ions, co-trapped in an electric Paul trap and separated by more than two micrometers. We measured a weak, millihertz scale, magnetic interaction between their electronic spins, in the presence of magnetic noise that was six orders of magnitude larger than the respective magnetic fields the electrons apply on each other. Spin dynamics was restricted to a Decoherence Free Subspace where a coherent evolution of 15 s led to spin-entanglement. Finally, by varying the separation between the two ions, we were able to recover the cubic distance dependence of the interaction

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