## Rotating reduced size STM for high magnetic fields experiments

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Cryogenic Scanning Tunneling Microscopy (STM) has been instrumental in the development of scanning probe microscopies. The addition of a magnetic field opens new prospects, such as the observation of vortex lattices in superconductors or of Landau quantization. For the latter, it is of particular importance to decrease as far as possible the size of the STM. Although efforts made during past years have led to some improvements, the size is still far above the typical sizes available for instruments used in high magnetic fields. Here we discuss the development of both a reduced size STM and a rotating platform meant to obtain measurements at different angles between the sample and the magnetic field. This feature will allow us to observe new exotic phases emerging at high tilted magnetic fields [1, 2], unreachable using state of the art three-axis coils [3]. Both the head and the base of the main body of the STM have been manufactured through 3D printing in grade 3 Titanium, which could turn out to be a good method to optimize the weight without modifying too much the stiffness of the microscope. Finite element calculations of the 3D printed system support the latter aspect. The STM has a diameter of 16 mm and a height of 25 mm. We have succesfully tested the stability of the system by reproducing millions of atomic-sized gold junctions at fields of 8 T in different orientations. We have also obtained images of the tilted vortex lattice and achieved atomic resolution in 2H-NbSe2, demonstrating the proper functioning of the rotatory system together with the STM.

### References

[1] K. Kumagai et al, Phys Rev Lett. 97(22), 227002 (2006).

[2] S. Kasahara et al. Proceedings of the National Academy of Sciences, 111(46), 16309-16313 (2014).

[3] J.A. Galvis et al. Rev. Sci. Instrum. 86, 013706 (2015).