# Instrumental Aspects of Force Detected ESR at 94GHz

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There are several advantages to conducting force detected magnetic resonance experiments at higher frequencies. For ESR based experiments, working at higher fields and frequencies offers increased g-resolution and a lower power requirement for a given value of the rotating field $B_1$, as well as greater sample polarization; at 3.3 T ($\approx$ 94GHz for $g = 2$) and at helium temperatures, a electron system will be almost 50% polarized. As well as these benefits, at frequencies of this order, the dimensions of resonators start to become more suited to integration with scanning probe systems.

There are, however, technical challenges associated with working at higher frequencies, mostly associated with the requirements for the high frequency oscillating fields. Such challenges may be overcome by techniques now widely used in high-field ESR instrumentation and this talk will describe preliminary experiments carried out in St Andrews at 94GHz. Quasi-optical techniques are used to couple mm-waves to a sample in a non-resonant holder via a polarization preserving corrugated pipe. This has the advantage of very low loss compared to single-mode waveguide or co-ax and allows for the in-situ measurement of the ESR spectrum.

An overview will be given of relevant mm-wave techniques and sources and an outline will be presented of possibilities for integrating mm-wave systems with existing MRFM experiments, where space constraints complicate matters further.