

# 1 GHz NMR Investigation of RNA: A New Frontier

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The successful commissioning of the world's highest magnetic field 1 GHz (proton) Bruker NMR spectrometer at ENS-Lyon in France marks a significant milestone in the annals of NMR instrumentation. As a practitioner of NMR in chemical and biological research, it is always exhilarating to use a new higher field spectrometer. The prospect of using the 1000 MHz instrument seemed almost fanciful, akin to the excitement surrounding a batsman waiting to score a century in Test Cricket! Over the years, NMR theory and instrumentation have advanced symbiotically and contributed to the rapid developments witnessed today and to be ranked as the foremost analytical technique.

An important achievement of high field NMR is the determination of three dimensional structures of complex protein macromolecules in native solution state as a complementary technique to X-ray crystallography. In recent years, following the discovery of the catalytic properties of RNA, determination of the three dimensional structures of biologically significant RNAs have received wide attention, especially in the USA. Unlike protein NMR, structure determination of RNAs poses a greater challenge due to its intrinsic physical, chemical and biological properties resulting in lower sensitivity and narrow spectral dispersion. Thus use of ultra high field NMR spectrometer alleviates much of the spectral complexities and speeds up the structure calculation process.

Our research group was one of the first to gain access to the 1 GHz spectrometer at Lyon following the vetting of our research proposal submitted under the EU-NMR access review procedure. In addition to the ultra high 1 GHz (= 23.5 Tesla) magnetic field, the spectrometer is also equipped with a cryo cooled probe and other accessories to render unsurpassed sensitivity. We successfully used these advanced conditions to carry out several multidimensional NMR experiments of RNAs and their complexes. The new vista in RNA research warrants an even higher field NMR spectrometer in the new decade and hopefully a Bruker 1.2 GHz spectrometer is looming on the horizon, pushing the frontier even further.

