Accelerated 2D magnetic resonance spectroscopy of single spins using matrix completion

Fri, 2016-06-03 14:59 - Oliver Marty [1] **Date:** 2015-08-12 - 2015-10-23

Author(s):
Jochen Scheuer, Alexander Stark, Matthias Kost, Martin B. Plenio, Boris Naydenov, and Fedor Jelezko

Reference:
Scientific Reports 5, 17728

URL:
http://www.nature.com/articles/srep17728 [2]

Two dimensional nuclear magnetic resonance (NMR) spectroscopy is one of the major tools for analysing the chemical structure of organic molecules and proteins. Despite its power, this technique requires long measurement times, which, particularly in the recently emerging diamond based single molecule NMR, limits its application to stable samples. Here we demonstrate a method which allows to obtain the spectrum by collecting only a small fraction of the experimental data. Our method is based on matrix completion which can recover the full spectral information from randomly sampled data points. We confirm experimentally the applicability of this technique by performing two dimensional electron spin echo envelope modulation (ESEEM) experiments on a two spin system consisting of a single nitrogen vacancy (NV) centre in diamond coupled to a single 13C nuclear spin. The signal to noise ratio of the recovered 2D spectrum is compared to the Fourier transform of randomly subsampled data, where we observe a strong suppression of the noise when the matrix completion algorithm is applied. We show that the peaks in the spectrum can be obtained with only 10% of the total number of the data points. We believe that our results reported here can find an application in all types of two dimensional spectroscopy, as long as the measured matrices have a low rank.

- Result [3]
- SIQS [4]
- 16.10.Ns Nuclear spins [5]
- 16.20.Dc Defect centers in diamonds [6]