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## Spectra Denoising using Graphic Cards

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### Context

CSPTC

TEOS

PVDF-HFP

Electrospinning → membrane

MAS 7 mm

MAS 4 mm

V. Maneeratana et al, *Adv. Funct. Mater.* **2013**, *23*, 2872–2880

### Tools

#### CPMG Echoes

4 times signal increase

T<sub>2</sub> distortions

#### SVD denoising

Matrice de Hankel

H. Y. Carr and E. M. Purcell, *Phys. Rev.*, **1954**, *94*, 3, 630–638  
 S. Meiboom and D. Gill, *Rev. Sci. Instrum.*, **1958**, *29*, 8, 688–691  
 W. J. Malfait and W. E. Halter, *J. of Non-Cryst. Solids*, **2008**, *354*, 34, 4107–4114

J.A. Cadzow, *IEEE Trans. Acoust. Speech Signal Process*, **1988**, *36*, 49–62  
 P. Man, C. Bonhomme, F. Babonneau, *Solid State Nucl. Mag.*, **2014**, *61*-62, 28-34

### Results

#### CPU vs GPU

CPU : Central Processing Unit  
GPU : Graphics Processing Unit

CPU : 60-474 s / GPU : 3-20 s  
20 times speeder

S. Lahabar, and P. J. Narayanan, *IEEE International Symposium on Parallel Distributed Processing, IPDPS*, 2009, 1-10

#### SVD Parameters

MTEOS/TEOS 50/50  
29Si, CPMG, 4028 points, 22 SVD points

2014 columns  
512 columns  
128 columns  
32 columns  
no SVD

29Si CPMG, 4028 points, 2014 columns

75 SVD values  
50 SVD values  
47 SVD values  
25 SVD values  
no SVD

Square matrix, manual number of values  
Minimum signal / noise = 2

#### Real samples

CSPTC/TEOS/PVDF-HFP  
29Si, Hpdcc 4 days, 956 points, 478 columns

29Si, CPMG 4 days, 956 points, 478 columns

Improved results with preprocessing

#### Highlights

- Possible analysis of highly noisy spectra
- Short denoising time with GPU
- Easy to use
- Low cost (Nvidia GTX 750 = 120 €)

#### Future work

- Automatic number of SVD values
- NMRLab with Matlab
- Sparse matrix
- T<sub>2</sub> corrections

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