	Experiment title: VdW mediated exchange coupling interactions in a molecular array assembled on graphene	**Experiment number**: CH-6584
Beamline: ID32	**Date of experiment**: from: 10 May 2023 to: 16 May 2023	**Date of report**: 11/09/2023
Shifts: 18	**Local contact(s)**: Pamella Vasconcelos Borges de Pinho	*Received at ESRF:*

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Report:

This beamtime focused on the investigation of of several deposits of the $[Cu(dttt)_2]$ complex on graphene ($dttt^-$ = 1,3-dithiole-2-thione-4,5-dithiolate) with the thickness of 1 monolayer, 10 nm, and 70 nm by X-ray Magnetic Circular Dichroism (XMCD) and X-ray Natural Linear Dichroism (XNLD). The aim was to unveil the magnetic behaviour of the monolayer, investigating the potential intermolecular exchange interactions among spins assembled as chains on the surface. Additionally, it aimed to evidence the possible variation of magnetic properties arising in multilayer samples due to a modification of the assembly morphology. In addition, XNLD was employed to confirm our hypothesis about the molecular configuration once assembled on the surface.

All samples were prepared at the University of Florence and shipped to ESRF using a UHV suitcase. XMCD signals were acquired at the Cu $L_{2,3}$-edge at different temperatures (from 4K to 180K) and at normal (θ=0°) incidence.

Unfortunately, most of the proposed measurements were hindered by the technical issues encountered during the whole beamtime, hampering the acquisition of meaningful data both on the monolayer and 10-nm thick sample.
First, a considerable noise appeared on the spectra, strongly affecting the measurements of the monolayer sample for which a low signal-to-noise ratio was mandatory to match the proposal objectives. The reasons for this behaviour could be addressed to the following issues:

1. The electrometer was not well shielded and, despite all the precautions (turning off all the sources of noise around the cables, including temperature sensors and cryostat fans), a periodic noise detrimental to the signal of our sample was present;
2. A large quantity of ice formed during the measurements and subsequently melted, flooding the top of the cryo-magnet and causing additional noise;

Additionally, we believe significant sample damage induced by the continuous pressure rises occurred during each sample transfer Bad pressures were due to a failure of the bake-out procedure carried out the week before the beamtime.

Despite the technical issues described above, we acquired some good-quality XMCD spectra as a function of the temperature on the thickest sample (70 nm) since the Cu $L_{2,3}$ signal was more intense. However, a periodic noise was still detectable for most of the data collected on this sample.

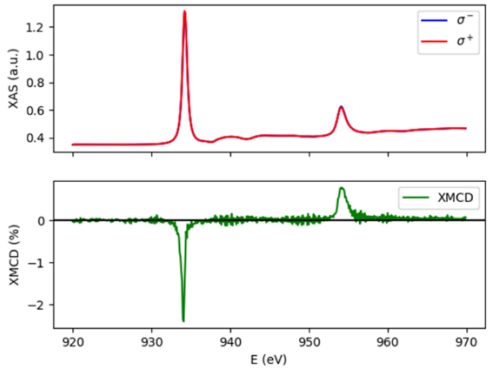

Figure 1. XMCD spectra of [Cu(dttt)$_2$]70nm@Gr acquired at 2K, theta 0° and 6T

While in the bulk phase, we observed the expected temperature trend in the evaporated sample the dichroic signal does not show any relevant dependence on temperature as this is hindered by the noise in the dichroic signal given by the diluted sample.