Contribution ID: **255** Type: **Poster**

Superconductivity in $TiSe_2$ Under Hydrostatic Pressure

Tuesday, 30 August 2022 18:40 (20 minutes)

One of the key challenges in the condensed matter research field is understanding the pairing mechanisms that give rise to unconventional superconductivity. Transition metal dichalcogenides MX_2 (M = Nb, Ti, Ta, Mo and X = S, Se) are a class of materials that have been shown to exhibit competition between a charge density wave (CDW) and superconducting state [1]. In ambient conditions, $TiSe_2$ displays a CDW state in ambient conditions and has also been shown to undergo a superconducting transition when intercalated with Cu [2] and when hydrostatic pressure is applied [3]. Here, we have conducted a muon spin resonance (μ+SR) experiment on a powder sample of $TiSe_2$ under hydrostatic pressure. The measurements were conducted at the GPD beamline, Paul Scherrer Institute. Measurements were taken at high pressure (22.9 kbar) and at zero pressure in order to compare, and at two muon momentums of 100 MeV/c and 95 MeV/c. All these measurements were taken in field cooled conditions under 100 Gauss. We can say that the response from the lower momentum muons is mainly from the pressure cell, and the larger momentum muons respond more to the sample. We see a possible two s-wave gap behaviour for the high-pressure results, fixing T_C = 1.8K, Δ_1 = 1.03meV and Δ_2 = 0.096 meV where Δ is the maximum value of the gap for each contribution. Results from other μ+SR studies using copper doped $TiSe_2$ show a similar behaviour [4], suggesting these mechanisms are similar. Further analysis on these results shall allow us to put this material on an Uemura plot.

[1]J.Wilson,et al, Adv.In Phys.24.2,117(1975)
[2]A.D.Hillier et al, Phys.Rev.B 81, p.092507 (2010)
[3]Kusmartseva, et al. Phys.Rev letters, 103(23), p.236401 (2009)
[4]M.Zaberchik et al. Phys.Rev.B 81, p.220505(R) (2010)

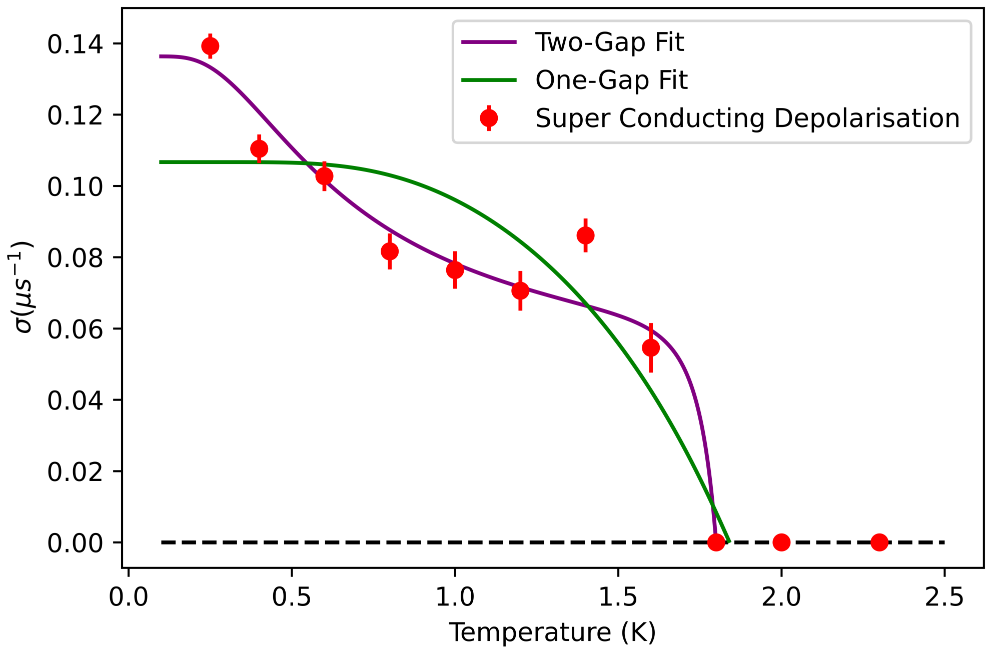

Figure 1: Temperature dependence of the relaxation rate from $TiSe_2$ under pressure.

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Session Classification: Posters

Track Classification: Superconductivity