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Magnetic phase diagram of F_2PNNNO[1]

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2-[2',6',-difluoro-4'-(N-*tert*-butyl-N-oxyamino)phenyl]-4,4,5,5-tetramethyl-4,5- dihydro-1H-imidazol-1-oxyl 3-oxide, F_2PNNNO for short, is an organic molecule containing two unpaired electrons. Residing in the N-*tert*-butyl nitroxide and nitronyl nitroxide groups, the two S=1/2 spins of these electrons are ferromagnetically coupled with an exchange constant of 407 K. In a crystal, two neighboring F_2PNNNO molecules form a pair in which the nitronyl-nitroxide spins are coupled antiferromagnetically with an exchange constant of 67 K. The magnetism of F_2PNNNO is that of the spin tetramers of these molecular pairs, which in turn are antiferromagnetically coupled with an exchange constant of 7.4 K [1]. Specific-heat and magnetocaloric-effect measurements reveal a highly symmetric boundary of the ordered phase in the phase diagram, with a lower critical field of H_{c1}=9.46 T and an upper critical field of H_{c2}=15.37 T. The ordering temperature T_c obeys a power law $T_c \sim (H - H_{c1})^\alpha$ near H_{c1}, with the exponent α approaching 2/3 in the low-temperature limit, indicative of a Bose-Einstein condensation (BEC) of |S, S_z >= |1,1> tetramers. Near the upper critical field H_{c2}, where one expects a BEC of singlet |0,0> tetramers in the "vacuum" comprising |1,1> tetramers, the corresponding power-law exponent remains around 0.4. Remarkably, the temperature dependence of the specific heat indicates that the magnon dispersion is independent of magnetic field between the two critical fields. This work is in collaboration with H. Tsujii, B. Andraka, Y. Hosokoshi, and K. Inoue. [1] Y. Hosokoshi *et al.*, *Phys. Rev. B* **60**, 12924 (1999).

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