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electric dipole superconductor in bilayer exciton system¹ QING-FENG SUN, QING-DONG JIANG, ZHI-QIANG BAO, X.C. XIE, ICQM, School of Physics, Peking University, Beijing, 100871, China — Recently, it was reported that the bilayer exciton systems could exhibit many new phenomena, including the large bilayer counterflow conductivity, the Coulomb drag, etc. These phenomena imply the formation of exciton condensate superfluid state. On the other hand, it is now well known that the superconductor is the condensate superfluid state of the Cooper pairs, which can be viewed as electric monopoles. In other words, the superconductor state is the electric monopole condensate superfluid state. Thus, one may wonder whether there exists electric dipole superfluid state. In this talk, we point out that the exciton in a bilayer system can be considered as a charge neutral electric dipole. And we derive the London-type and Ginzburg-Landau-type equations of electric dipole superconductivity. From these equations, we discover the Meissner-type effect (against spatial variation of magnetic fields), and the dipole current Josephson effect. The frequency in the AC Josephson effect of the dipole current is equal to that in the normal (monopole) superconductor. These results can provide direct evidence for the formation of exciton superfluid state in the bilayer systems and pave new ways to obtain the electric dipole current.

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