



# Organic-based Room Temperature Photochromism and Photomagnetism in 1,4-Bis(imidazolyl)benzene Systems: Sustainable Optoelectronic Devices and Optical Switches

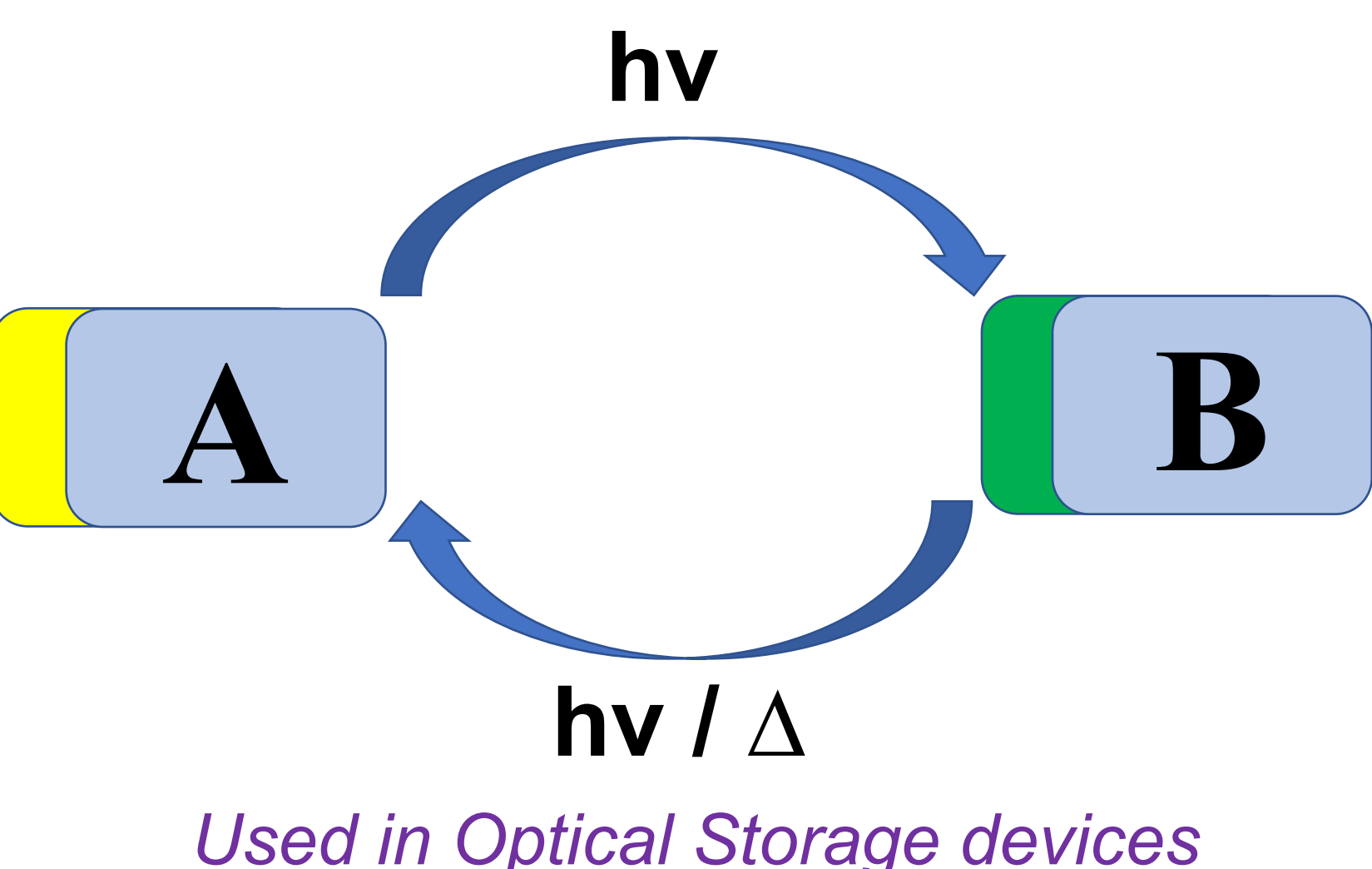
Dr. Subhajit Saha<sup>a</sup>, Dr. Sudipta Khamrui<sup>b</sup> and Prof. Kumar Biradha<sup>\*a</sup>

<sup>a</sup>Department of Chemistry, Indian Institute of Technology Kharagpur, India <sup>b</sup>Department of Physics, Indian Institute of Technology Kharagpur, India

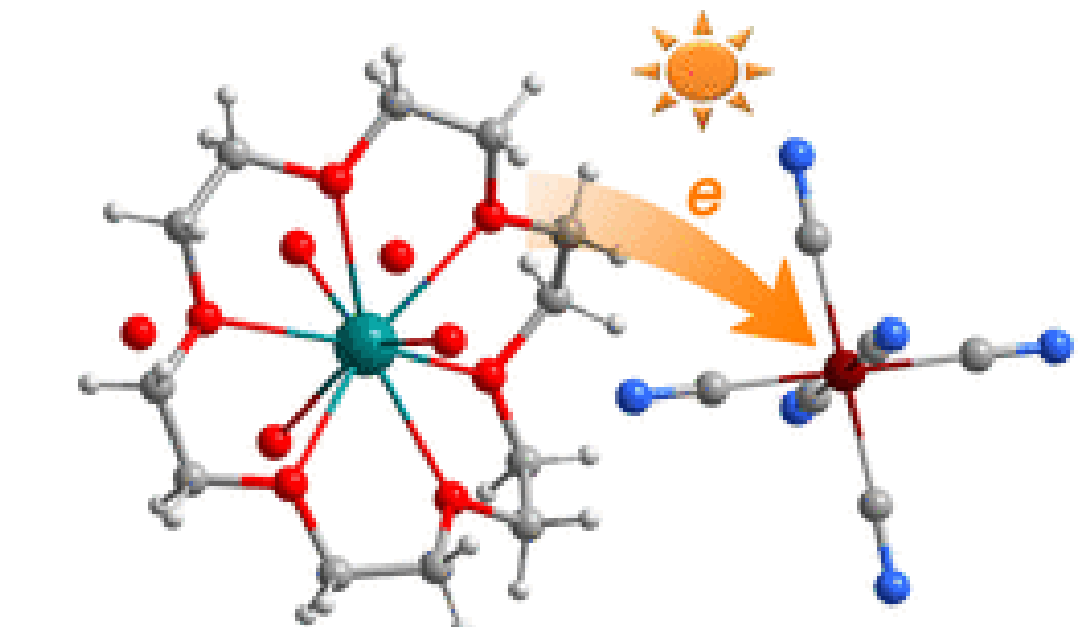
**Abstract:** Photochromism and photomagnetism are key phenomena for the development of next-generation optoelectronic devices and optical switches. However, very few systems, primarily metal-based, are known to simultaneously exhibit both properties at room temperature. Here, we report 1,4-bis(4,5-diphenyl-1H-imidazol-2-yl)benzene (BDPI) as the first easily synthesized and highly stable organic photomagnet, functioning without conventional photochromic couplers or radical precursors. Solvent-assisted hydrogen bonding fosters  $\pi \cdots \pi$  stacking between the 1,4-Bis(imidazolyl)benzene cores, enabling stable photoinduced free radicals and strong spin–spin interactions in the solid state. Halogen-substituted derivatives (Cl-BDPI & Br-BDPI) further modulate these properties, with Cl-BDPI and Br-BDPI showing rapid photochromism and stable radical generation at very high temperature (up to 170°C). Notably, Cl-BDPI undergoes a photoinduced antiferromagnetic-to-ferromagnetic transition with up to a 38% increase in magnetic moment at room temperature, which is the first occurrence of such a significant level of magnetization amplitude compared with previously reported metal–organic photomagnets.

## Literature Background

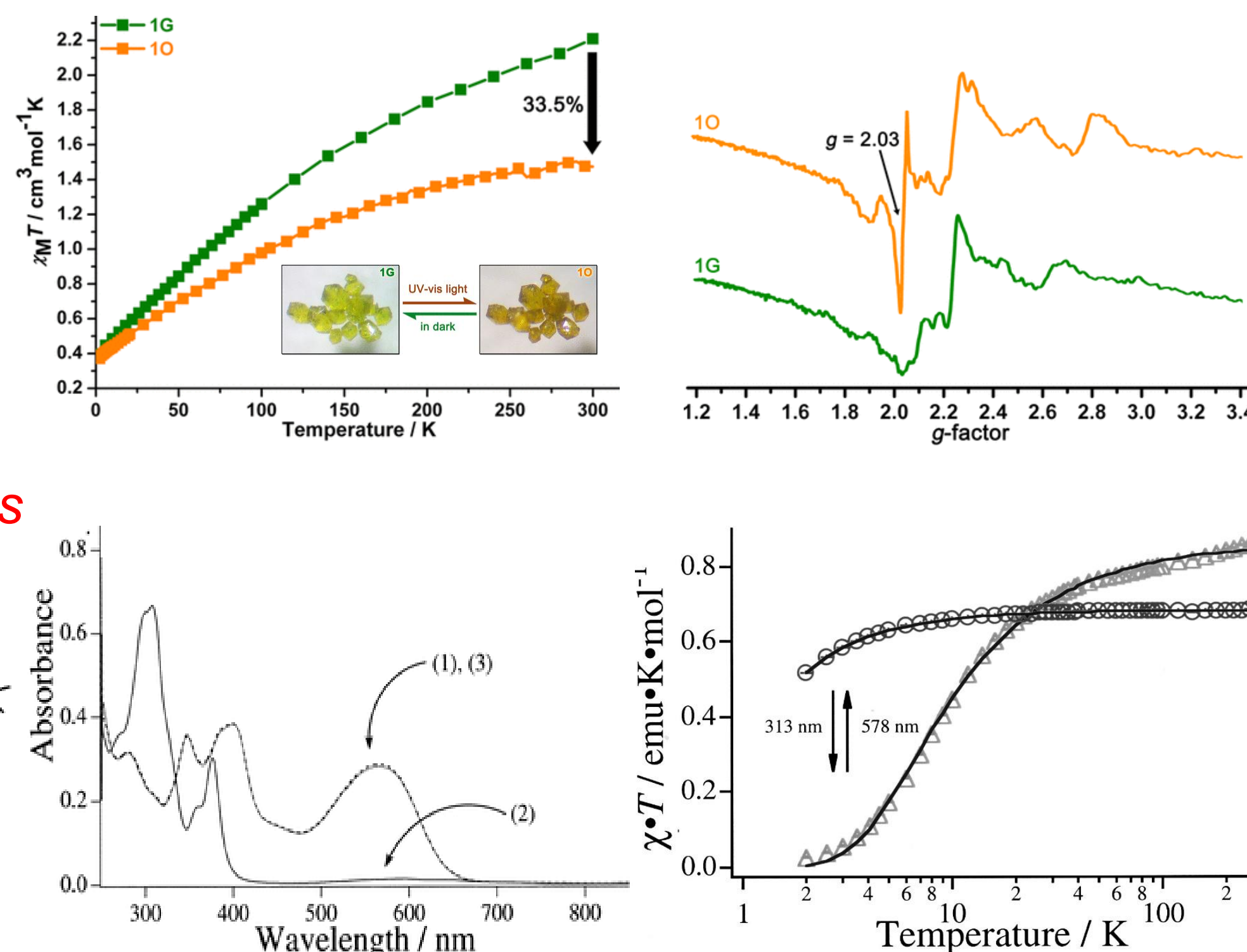
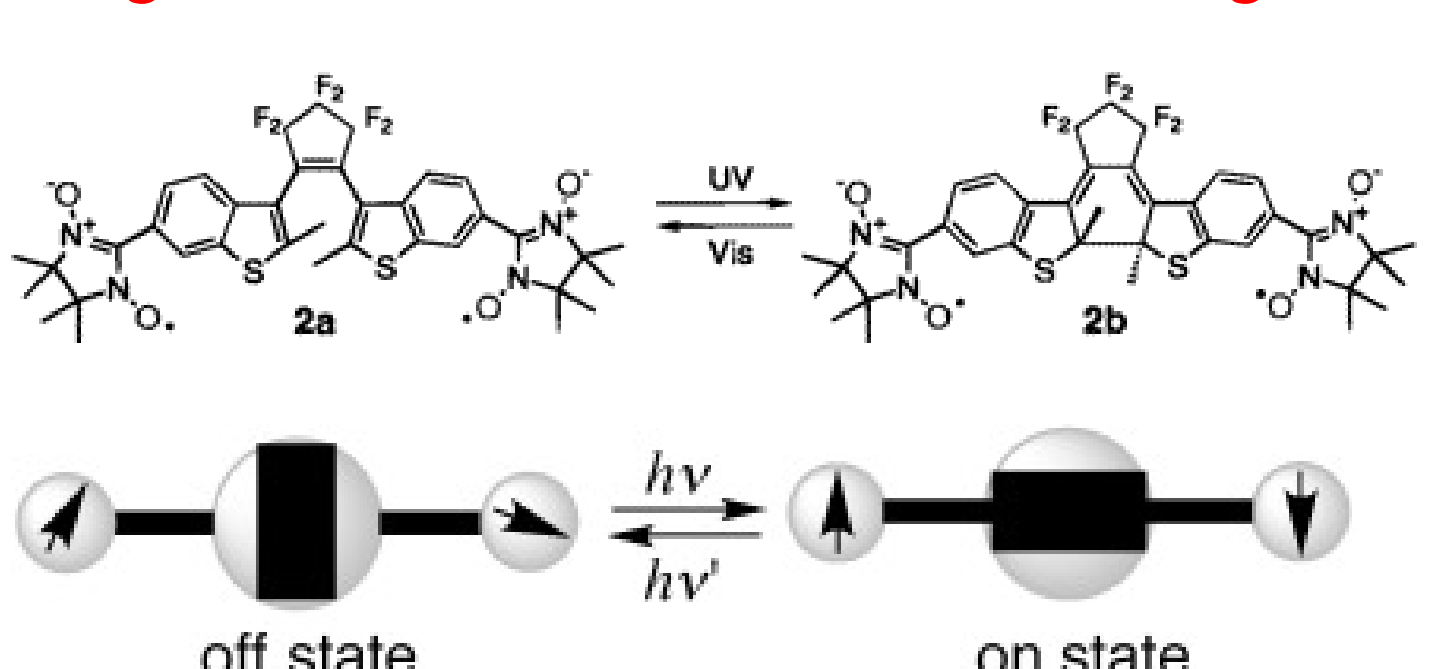
**Photochromism & Photomagnetism**  
when the color and magnetic moment values of A and B are different



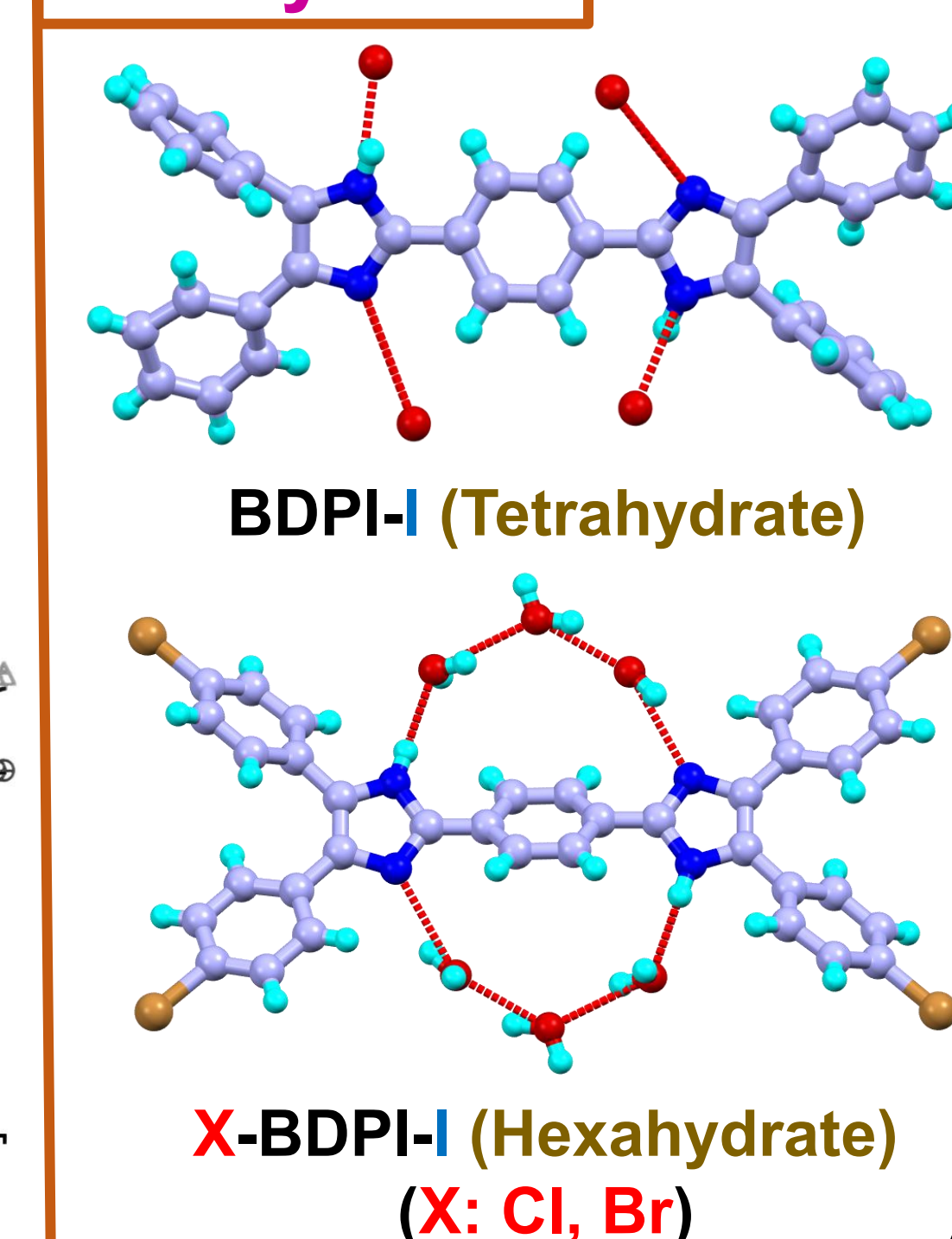
## Metal-based Photomagnets



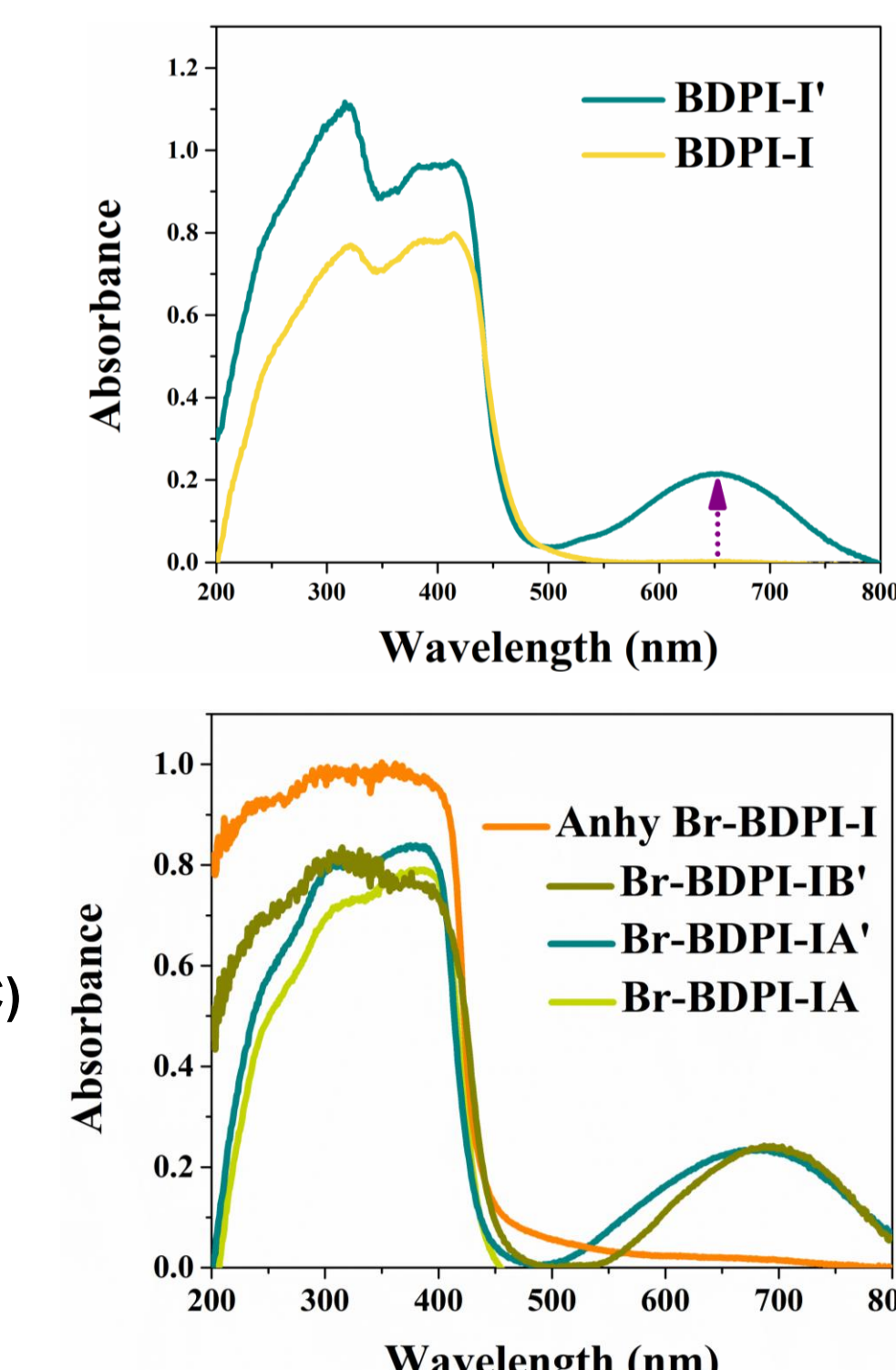
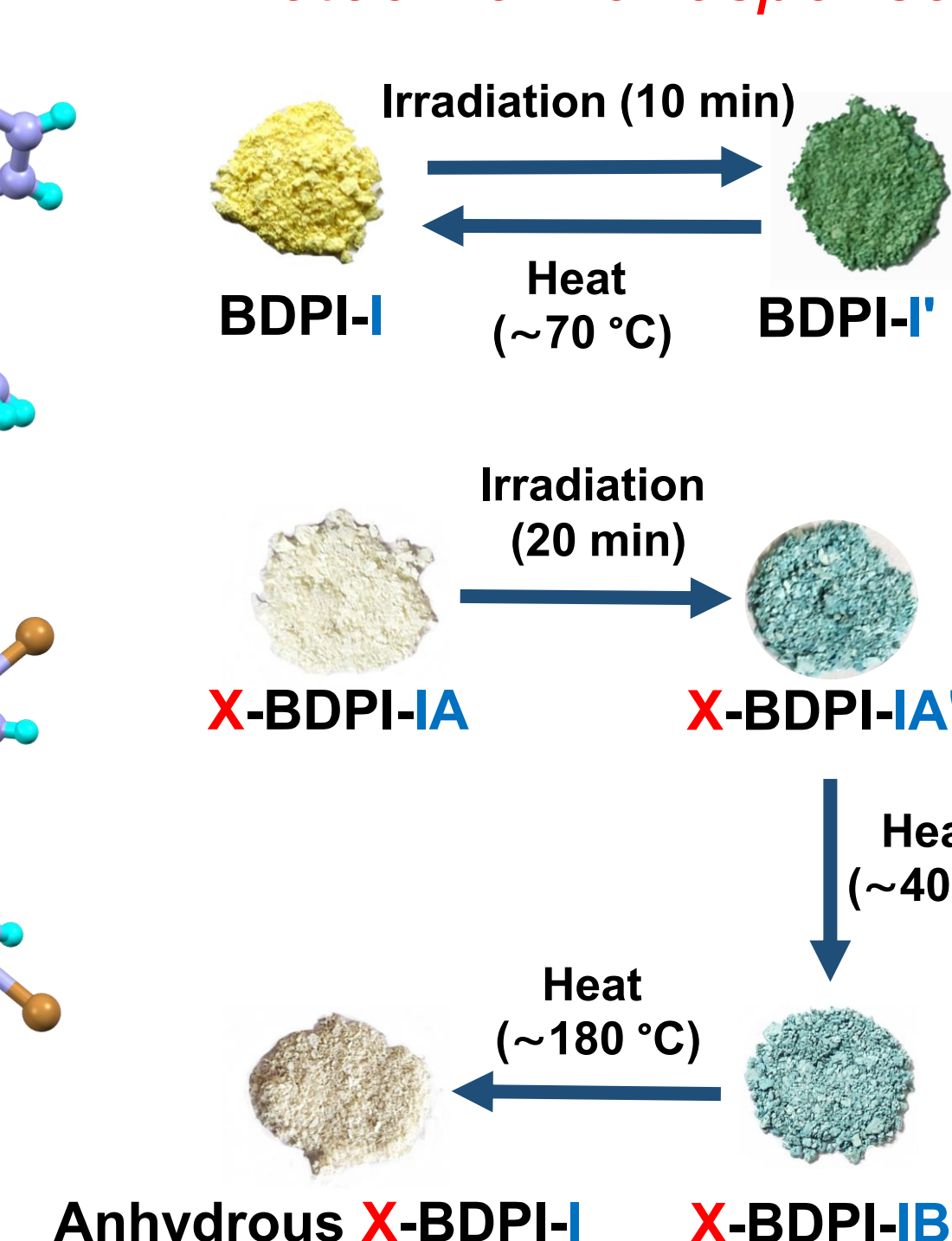
## Organic radical-based Photomagnets



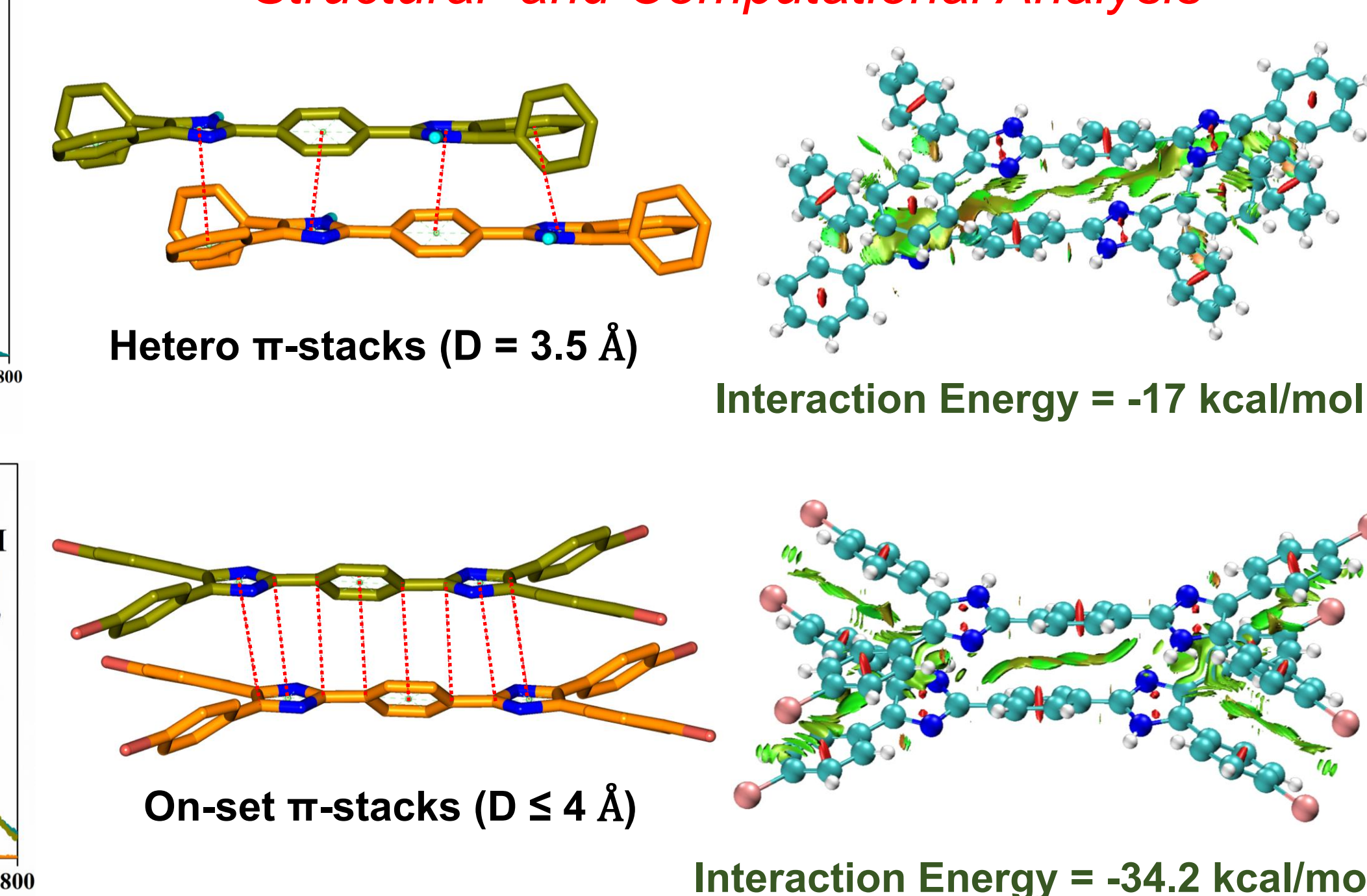
## Our Systems



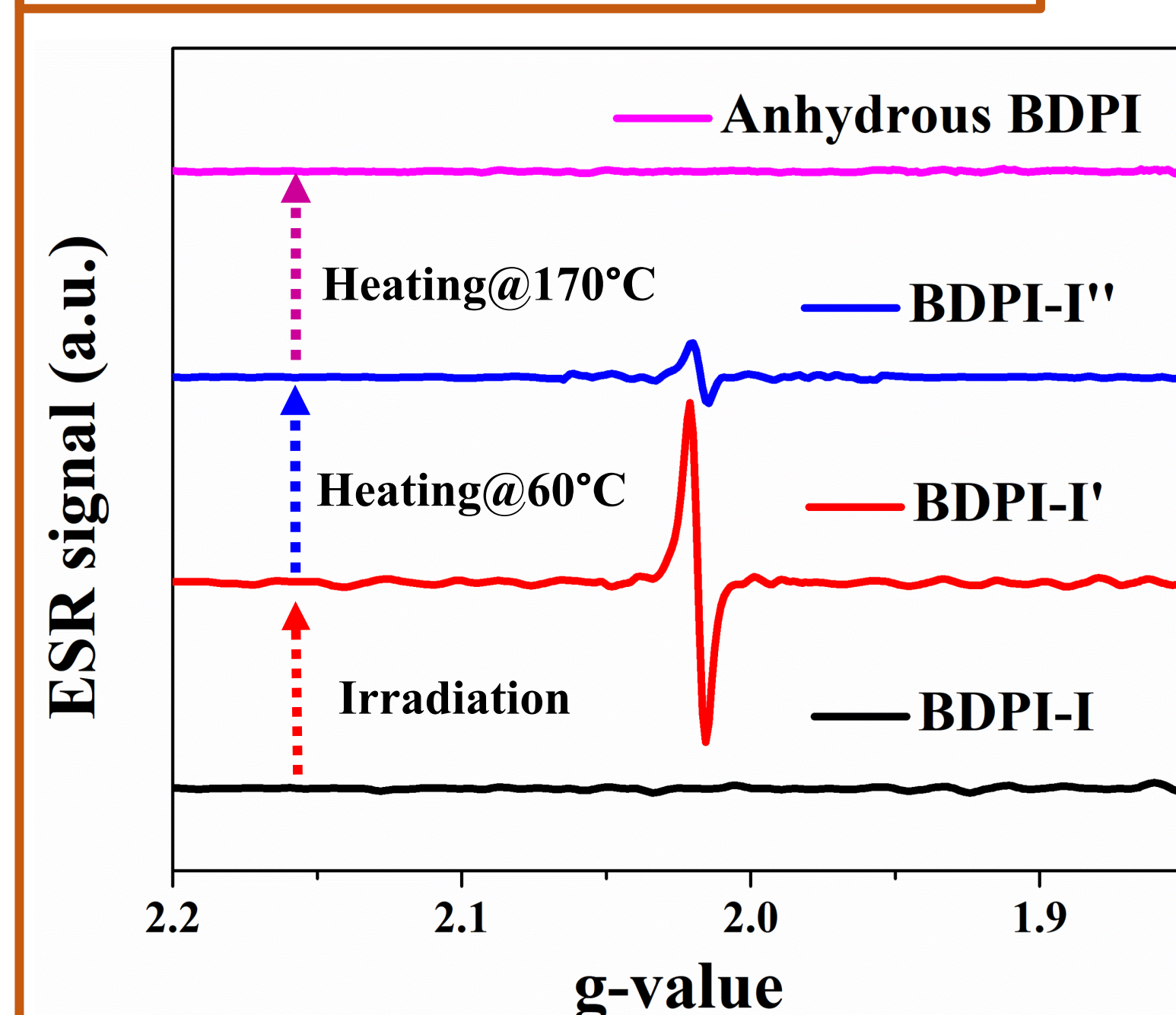
## Photochromic response



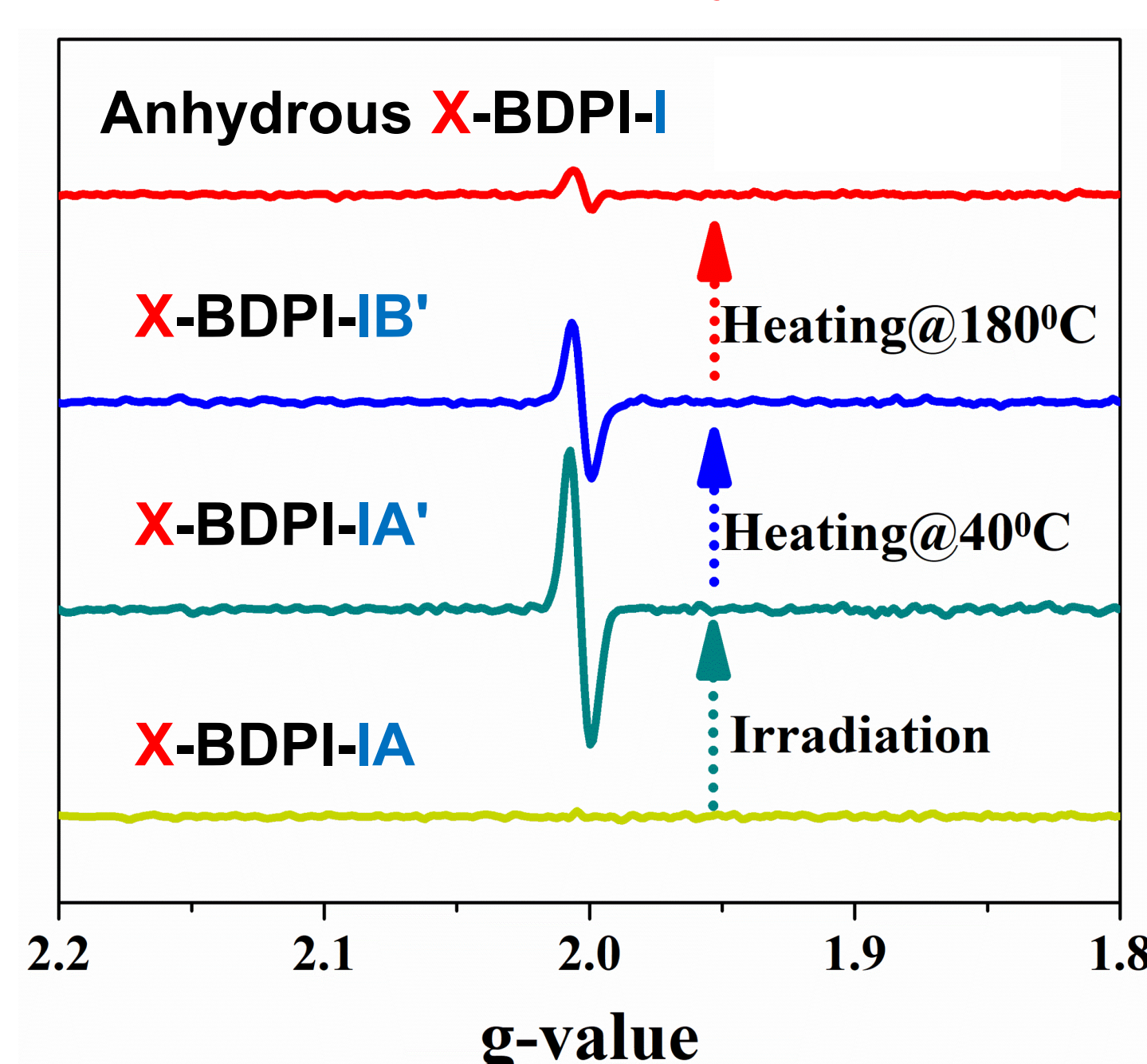
## Structural and Computational Analysis



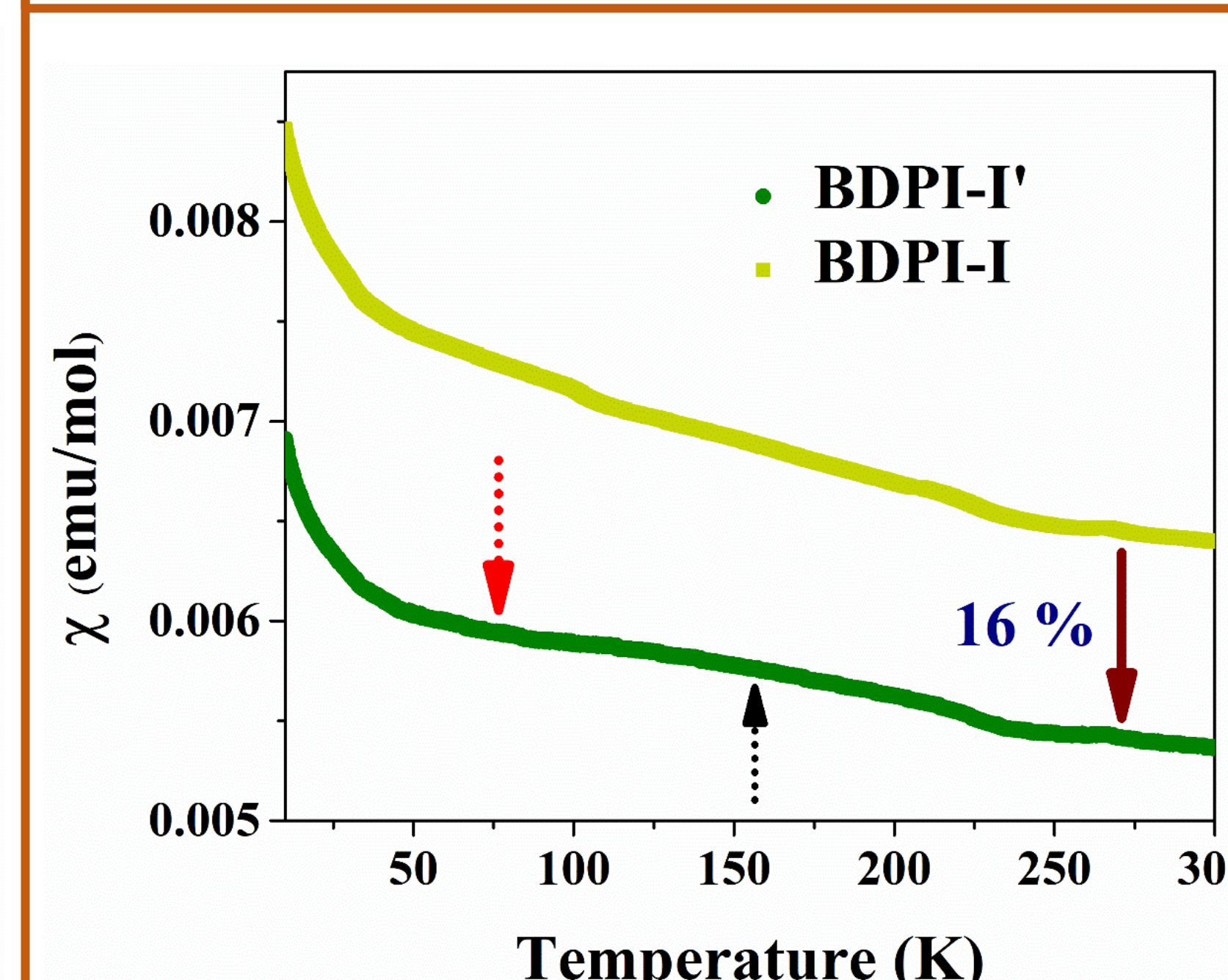
## Photoinduced Free Radicals



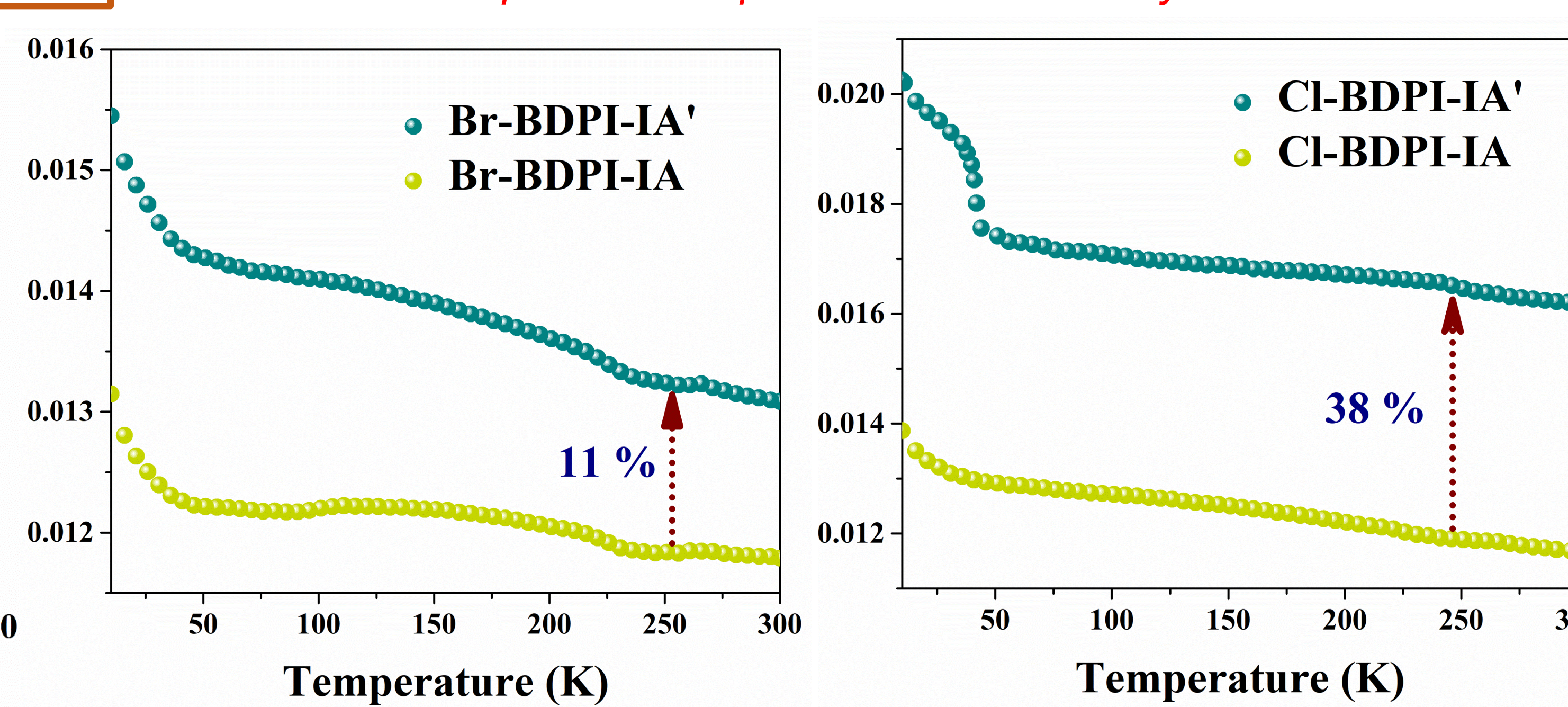
## Solid-state EPR Analysis



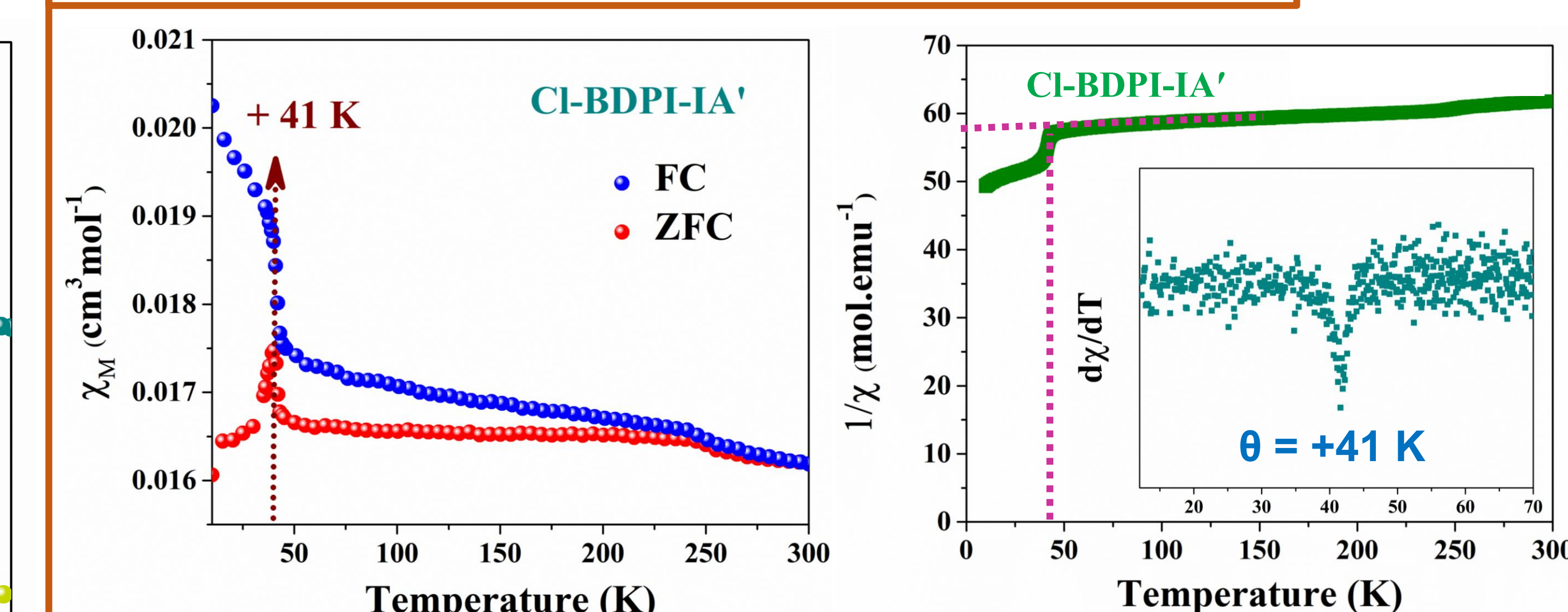
## Photomagnetism at Room Temperature



## Temperature Dependent SQUID Analysis



## Antiferromagnetic to Ferromagnetic Transition



**Conclusion** □ We have successfully developed new category of organic photochromic and photomagnetic material, which is low cost, highly stable and easily synthesized.  
□ Spin-orbit coupling effect in halogenated BDPI offers an excellent photomagnetic material with highest enhancement of magnetic moment value reported till date.

## Acknowledgement

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Dept. of Chemistry  
IIT Kharagpur, India

