

# Origin of Photoluminescence in S and N co-doped Carbon Dots

Manjunatha Ganiga and Jobin Cyriac

Department of Chemistry, Indian Institute of Space Science and Technology

Thiruvananthapuram, Kerala, INDIA – 695 547

Email: manjunathaganiga.13@gmail.com

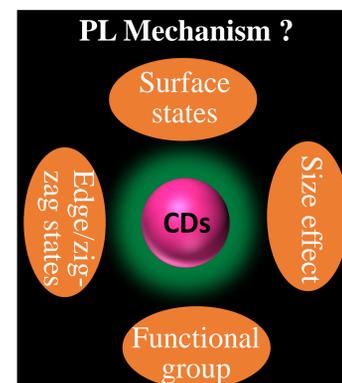


## Abstract

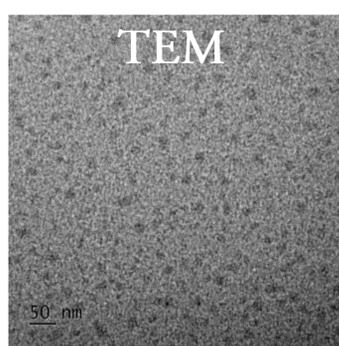
- S and N co-doped Carbon Dots (SNCDs) is prepared by the hydrothermal treatment of glutathione
- Fluorescence spectra of SNCDs shown three bands viz., two excitation independent bands at 380 and 430 nm and an excitation dependent band above 430 nm
- A detailed photophysical studies of SNCDs at different pH conditions were performed
- Based on the obtained results, we proposed a comprehensive energy level diagram, which explains the origin of luminescence in SNCDs

## Introduction

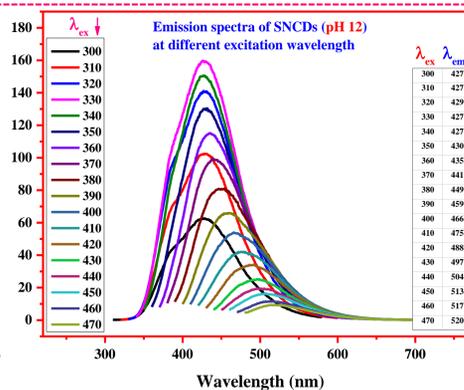
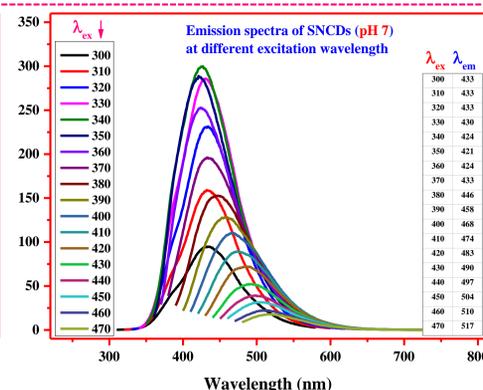
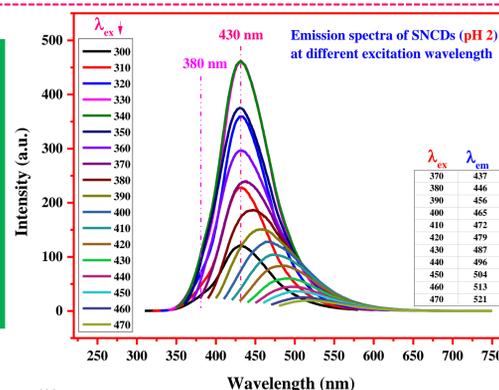
- Despite CDs possess excellent properties such as excitation dependent emission, biocompatibility and low toxicity, the underlying luminescence is blurry because of the complexity of the structure
- This hinders the tuning of photophysical properties of CDs and hence extension of its technological possibilities
- In the present report, we attempted to understand the origin of luminescence in co-doped CDs by studying the photophysical behaviour of SNCDs at different pH conditions



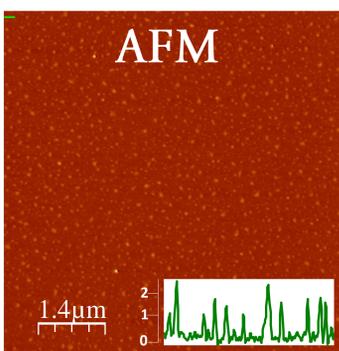
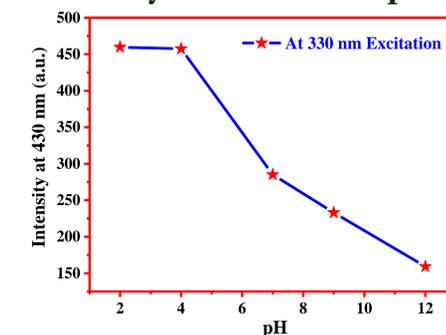
## Results and Discussion



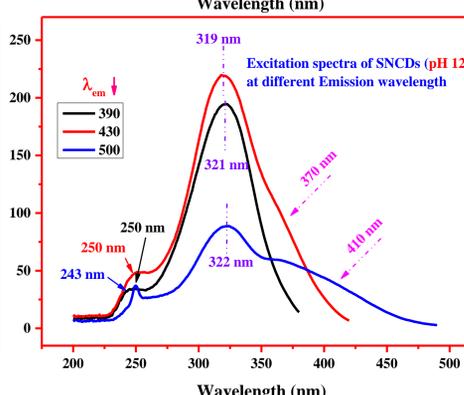
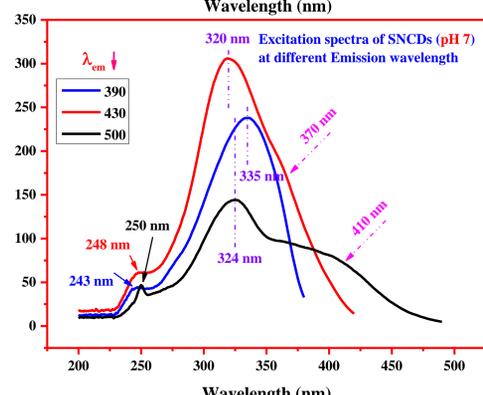
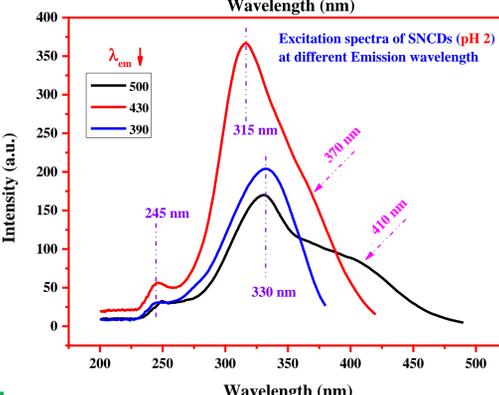
PL Emission at different pH



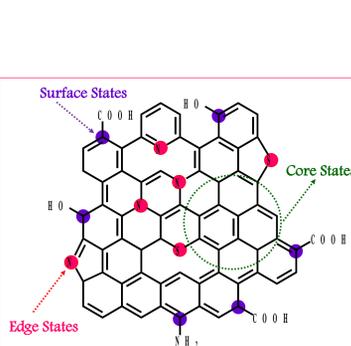
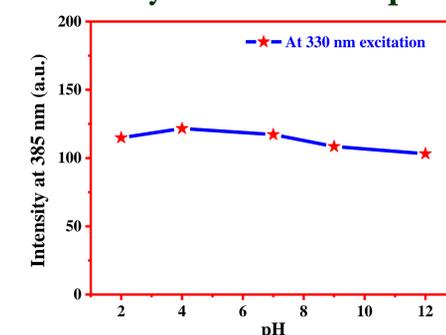
### Intensity of 430 nm v/s pH



PL Excitation at different pH



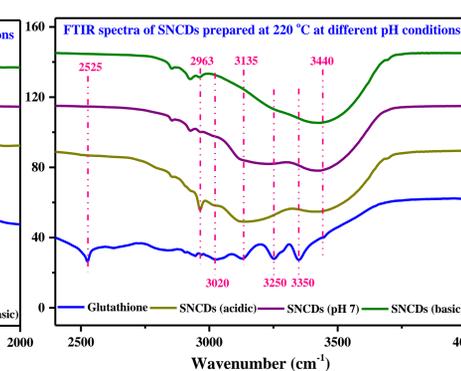
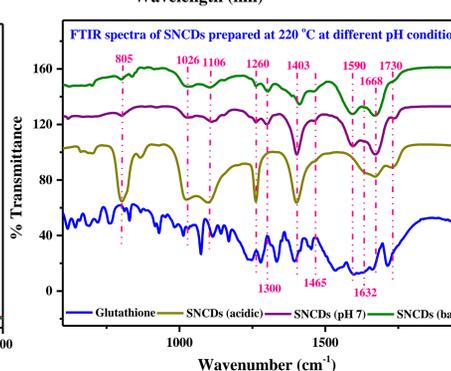
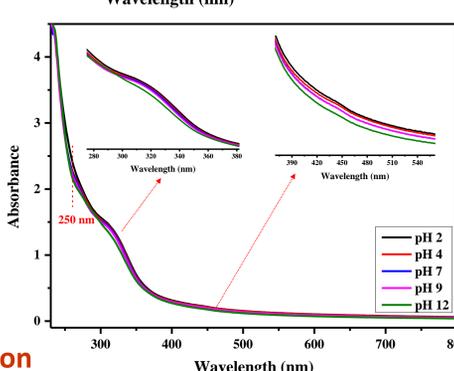
### Intensity of 380 nm v/s pH



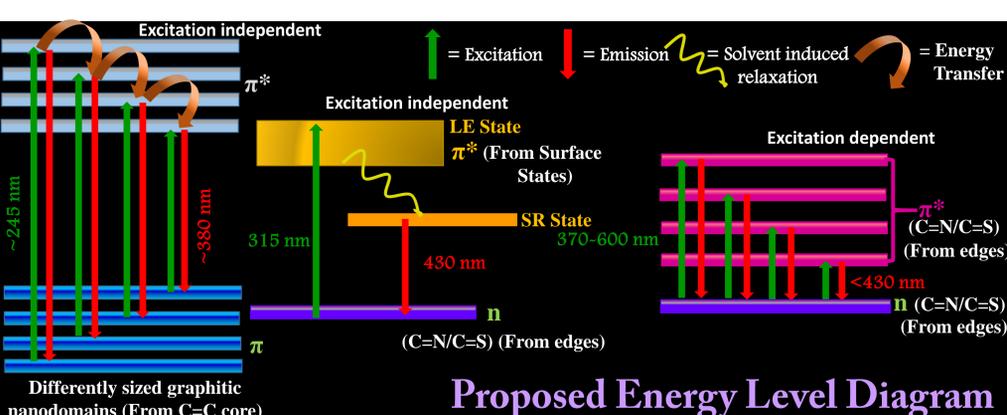
Lifetime Analysis at 430 nm collection

Collection	$\Delta_{430}$	$\tau_1$ (ns)	$A_1$	$\tau_2$ (ns)	$A_2$
pH 2	4.7	8.48	11.8	91.52	
pH 4	4.2	11.52	11.6	88.48	
pH 7	5.3	13.13	12.1	86.87	
pH 9	4.9	21.83	12.1	78.17	
pH 12	3.6	28.18	11.8	71.82	

UV-Visible & FTIR



380 nm Emission → 430 nm Emission



## Conclusions

- The synthesis of SNCDs and a detailed photophysical studies at different pH conditions (2, 4, 7, 9, 12) has been accomplished
- Based on the results obtained, we proposed a comprehensive energy level diagram for SNCDs, which explain the origin of luminescence in SNCDs
- The studies may be useful in understanding the CDs and related materials and hence to expand its technological possibilities

## Acknowledgement

- Authors deeply acknowledge IIST for funding
- STIC-CUSAT for Characterization

## References

- M. Ganiga and J. Cyriac, *ChemPhysChem*, 17, 2315–2321
- S. N. Baker and G. A. Baker, *Angew. Chem. Int. Ed.* 2010, 49, 6726 – 6744