



## PhD Program between the Freie Universität Berlin (FUB) and the China Scholarship Council (CSC)

### Open PhD position at FUB for CSC scholarship candidates 2018

*Please note: the PhD position is only offered to Chinese PhD candidates for application in the framework of the FUB-CSC PhD Program.*

<b><u>Department/Institute:</u></b>	Biology-Chemistry-Pharmacy, Institute of Chemistry
<b><u>Subject area:</u></b>	Inorganic Chemistry
<b><u>Name of Supervisor:</u></b>	Prof. Dr. Christian Müller
<b><u>Number of open PhD positions:</u></b>	1
<b><u>Type of the PhD Study:</u></b>	Full-time
<b><u>Project title:</u></b>	Activation of E-H-bonds (E = N, O) by aromatic phosphorus heterocycles

#### **PhD Project description:**

The selective activation and functionalization of amines and alcohols by means of catalytic reactions is still a major challenge in molecular inorganic chemistry. We could recently demonstrate a reversible O-H-activation of alcohols by a main-group-element compound and would like to investigate this interesting reaction, as well as subsequent steps in detail, also for amines. Starting point for the activation of E-H bonds (E = N, O) is the use of aromatic phosphorus(III) heterocycles and derivatives thereof. Because the cleavage of the N-H and O-H bond will strongly depend on the electronic properties of such low-coordinate phosphorus compounds we will first synthesize a library of 2,4,6-triaryl- $\lambda^3$ -phosphinines, which differ significantly in their  $\pi$ -acceptor,  $\sigma$ -donor as well as  $\pi$ -donor properties. Initial studies on varying such properties by introducing certain substituents into specific positions of the phosphorus heterocycle have already been published by us. These phosphinines will be used for the activation of ammonia and alcohols. Moreover, the metal-induced reaction of ammonia and alcohols with phosphine-based transition metal complexes will be studied. In contrast to free phosphinines, the addition of the N-H- and O-H bond proceeds in this case at the P=C-double bond. There is ample room for mechanistic investigations for all three systems, which will be supported experimentally as well as by means of quantum chemical calculations. Moreover, the nature of the P-H bond has to be clarified by means of reactivity studies. Subsequently possible follow-up reactions will be performed, such as the insertion of an alkene into the P-H-bond, or the transfer of the  $-NH_2$ -group to aldehydes or ketones. If this is successful, reductive elimination reactions will be studied, which will consequently lead to a (catalytic) functionalization of ammonia as well as alcohols by means of aromatic phosphorus heterocycles.

#### **Language requirements:**

IELTS: 6.5 or TOEFL: 95 ibt.

#### **Academic requirements:**

Master in Chemistry  
Experience in preparative Organic, Inorganic and Organometallic Chemistry, Coordination Chemistry. NMR-Spectroscopy.

**Information of the professor or research group leader (website, awards etc.):**

[www.bcp.fu-berlin.de/ak-mueller](http://www.bcp.fu-berlin.de/ak-mueller)

Christian Müller was born in Germany in 1972. He studied Chemistry at the University of Bielefeld and the University of Michigan, Ann Arbor (USA) and received his Ph.D. under the supervision of Prof. Dr. P. Jutzi at the University of Bielefeld/Germany in 2000. He was awarded with a fellowship of the Deutsche Forschungsgemeinschaft (DFG) to work with Prof. Dr. W. D. Jones at the University of Rochester, New York (USA) and started in 2002 a second postdoc with Prof. Dr. P. W. N. M. van Leeuwen at the University of Amsterdam, The Netherlands. Afterwards he joined the group of Prof. Dr. D. Vogt at Eindhoven University of Technology in 2003 where he got appointed as Assistant Professor in 2004. In 2008 he received the prestigious Vidi grant from the Netherlands Organization of Scientific Research (NWO) to conduct research in the field of low-coordinate organophosphorus chemistry. He got appointed full Professor of Inorganic Chemistry at the Free University of Berlin, Germany, where he started in February 2012. His research interests are centered around the subjects "low-coordinate phosphorus and arsenic compounds", "activation of small molecules", "functional coordination compounds", and "homogeneous catalysis". Christian Müller has published more than 100 scientific papers and 4 book chapters.

**Honors and Awards**

2014 Member of the Scientific Advisory Council of the ScienceCampus Phosphorus Research, Rostock, Germany.

2012 Member of the Steering Committee International Conference on Phosphorus Chemistry (ICPC).

2008 Vidi award of "The Netherlands Organization for Scientific Research" (NWO).

2008 ChemComm price for innovative research in the field of ligand design.

2001: Price of the „Rheinisch-Westfälisch-Lippischen Universitätsgesellschaft“ for the best Ph.D. thesis in Chemistry at the University of Bielefeld/Germany.

2000: Postdoc-fellowship of the Deutsche Forschungsgemeinschaft (DFG).

1995: IAS-fellowship of the „Deutscher Akademischer Austauschdienst“ (DAAD) for USA.

1991: Book-price for the best university-entrance diploma in chemistry.

**Please note:** In a first step, the complete application must be submitted to the Beijing Office for evaluation by January 4<sup>th</sup>, 2018. Please do not contact the professor before. He/She will get in contact with you after having received the complete application via the Beijing Office in January.