**Institution:** Nicolaus Copernicus University; Faculty of Physics, Astronomy and Informatics

**City:** Toruń

**Position: PhD student / doktorant**

**Research field:** Physics

**Posted:**

**Expires:** 30.06.2022

**Offer starting date:** 25.04.2022

**Number of offers:** 1

**Type of contract:** Temporary

**Job status:** Full-time

**Hours per week:** 40 hour / week

**Offer description:**

Project leader: prof. dr hab. Roman Ciuryło.

Project title: “Ultracold molecules for fundamental interactions sensing”.

The project is carried out in the National Laboratory FAMO within the OPUS 21 programme of the National Science Centre (NCN). The National Laboratory FAMO is a leading Polish research-oriented institution focused on atomic, molecular, and optical physics problems. Currently, several European projects are realized in National Laboratory FAMO, including: Quantum Flagship and EMPIR concerning ultra-cold atoms, quantum control, and optical atomic clocks.

This project is devoted to developing a new molecular sensor to allow the study of fundamental interactions. The energetic structure of molecules determined by the interaction between their components and the surrounding space will be utilized to look for exotic interactions like hadron-hadron fifth forces, non-Newtonian gravitation or perturbations by dark matter fields. We will use isotopologues of the heavy Hg2 molecules to look for signatures of additional interactions beyond the Standard Model at the nano-scale. Our approach relies on the confrontation of accurate spectroscopic measurements with theoretical calculations. For this purpose, we will measure near-threshold bound states of the Hg2 molecule. Taking advantage of the relatively simple dispersion form of the long-range part of interaction potential supporting these states, we will be able to reduces the influence of any inaccuracies in the description of the short-range part of the potential on the sensitivity of the comparison of theoretical and experimental spectra to additional interactions. We also start the effort to develop an optical molecular clock. This approach is complementary to research with H2 isotopologues, also ongoing in our laboratory, extending the separation range of atoms in which fundamental interactions can be studied.

This PhD student position will be an appointment for the project entitled “Ultracold molecules for fundamental interactions sensing”

Key responsibilities include: PhD student will be involved in developing of a control system of the dipole trap for ultracold atoms. She or he will participate in developing an experimental system for photoassociation spectroscopy including laser beam frequency modulation, laser beam shaping, laser frequency locking, vacuum system assembling, etc. The student will be responsible for collecting two-colour photoassociation spectra and their analysis. She or he can also be involved in theoretical calculations of photoassociation spectra and their application in search of new physics beyond the Standard Model.

**Selection process/Required documents:**

Required documents:

1. CV,

2. motivation letter (including a description of scientific motivation, a description of research interests, and a publication list),

3. contact details to at least one academic referee.

4. a scan or photocopy of the candidate’s university degree;

5. Copy of scan of language certificate (if any),

6. Copy or scan of candidate’s publications (if any),

7. Consent to the processing of personal data (Appendix 1).

8. At least one recommendation letter.

**Skills/Qualifications:**

* Strong oral and written communication skills in English,
* The candidate should demonstrate an open mind, independent thinking and a willingness to bring new ideas to the project

**Benefits:**

We offer:

Maximum period of contract/stipend agreement: 48 months / 5.000,00 PLN/month,

Job type (employment contract/stipend): stipend,

Opportunity to work in interdisciplinary research department with strong support from astronomy and physics groups within the department,

Collaboration with the best research groups in the world in the field of dark matter detection with optical atomic clocks,

International collaboration,

International internships and the possibility to present research results at international conferences.

**Offer Requirements:**

1. Master’s degree in Physics or related,

2. documented scientific expertise in one of the following disciplines:

optical spectroscopy,

atomic/molecular physics,

experience with ultrastable cavities,

molecular spectroscopy,

ultracold atoms,

photoassociation,

fundamental interactions

3. experience in numerical simulations or programming,

4. strong oral and written communication skills in English,

5. willingness to include the research results in the PhD thesis.

**Please include in your offer:**

“I hereby give consent for my personal data included in my application to be processed for the purposes of the recruitment process under the Personal Data Protection Act as of 10 May 2018 (consolidated text: Journal of Laws 2019, item 1781) and pursuant to art. 6 § 1a GDPR (General Data Protection Regulation - EU 2016/279)."

**Additional information:**

Documents should be submitted to Karolina Kitkowska at: [karolina.kitkowska@umk.pl](mailto:karolina.kitkowska@umk.pl) before 30.06.2022 The applicants will be contacted for interview to schedule time.