Graduate Studies in Nuclear Physics at

# The College of William and Mary

### Nuclear and Neutrino Group:

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|---|---|
| Experimental Faculty: | 11 |
| Theoretical Faculty: | 5 |
| Postdoctoral Researchers: | 6 |
| Graduate Students: | 31 |
| Female Students: | 7 |

### Rankings (US News and World Report):

W&M ranked 6th amongst public US universities

### Physics Department Statistics:

Average annual number of Ph. D. recipients: 8
Average time to Ph. D.: 5 years

### Departmental Website:

http://www.wm.edu/physics
http://www.wm.edu/as/physics/research/index.php

### Graduate Admissions:

http://www.wm.edu/as/physics/grad/index.php
Application deadline: Feb 1st

### Contact in Nuclear Physics:

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*William Small Physical Laboratory*

## General Information:

The College of William and Mary (W&M), chartered in 1693, is the second oldest university in the US. It boasts four US presidents, supreme court justices and Jon Stewart as alumni. W&M is a liberal arts university with a strong research focus. Our 7,800 students (2,000 of them graduate students) enjoy a low student-to-faculty ratio, state-of-the-art facilities, and a beautiful campus.

Located in Williamsburg, Virginia, W&M is in the heart of colonial American history and is adjacent to Colonial Williamsburg, a historic recreation of 18th century colonial life. While much of the campus has been restored to its 18th-century appearance, the physics department is housed in a newly refurbished and expanded building that provides outstanding teaching and research space.

The William and Mary physics department benefits enormously from close ties with both Thomas Jefferson National Accelerator Facility (JLab) and NASA Langley Research Center in nearby Newport News (thirty minutes from the W&M campus). In medium energy nuclear physics, JLab offers unparalleled facilities for research and training of our students. Several W&M faculty have joint positions at JLab and several JLab scientists have roles at W&M.

The physics department also has a strong program in both theoretical and experimental high-energy physics. The experimental high-energy program concentrates on neutrino physics and is involved in both accelerator-based (MINOS, NOvA, and MINERνA experiments at Fermilab) and reactor-based (Daya Bay) projects.

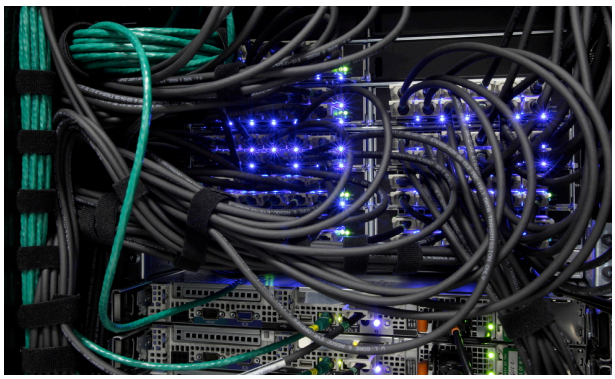
### Research Areas

Atomic, Molecular and Optical Physics
Condensed Matter Physics
High Energy Physics
Nonlinear and Plasma Physics
Nuclear and Hadronic Physics

*Qweak experiment @ JLab*

*MINOS detector @ Soudan Mine*

*$^3$He target lab @ W&M*



*Lattice QCD computers @ W&M*

## Experimental Hadronic Physics

Our experimental research program centers is focused on research at JLab and graduate students spend much of their time their after the first two years of study. Our core research program centers on four areas: studies of strange quark form-factors in the nucleon via parity violation, nucleon spin-structure experiments using polarized targets developed at W&M, nucleon electromagnetic form factors, and precision searches for physics beyond the Standard Model via the weak interaction.

We are actively involved in the QWeak, G0, HAPPEx, PVDIS, SoLID, and MOLLER experiments, in the transversity and polarized $^3$He programs in Hall A, in the electromagnetic form factor and two-photon exchange programs in Hall A and C, in deep-inelastic scattering experiments with the SuperBigBite spectrometer in Hall A, and the CLAS12 collaboration.

Our faculty also actively collaborate on experiments in Mainz, Oak Ridge, TRIUMF, HI$\gamma$S and on the development of a planned Electron-Ion Collider.

## Experimental Particle Physics

At W&M we are studying neutrino oscillations using an accelerator-produced neutrino beam and the MINOS and NOvA detectors at Fermilab. We also searching for oscillations using anti-neutrinos produced by nuclear reactors at Daya Bay in China. Because neutrinos only couple to the weak nuclear force, their interactions with matter are not well measured and understood. We are conducting an experiment at Fermilab, MINER$\nu$A, which will make high precision measurements of neutrino cross-sections to support oscillation experiments and will also measure nucleon/nuclear structure in a way that's complementary to the electron scattering measurements made at Jefferson Lab.

## Theoretical Nuclear and Particle Physics

Research in theoretical nuclear and particle physics focuses on understanding aspects of the Standard Model and beyond using a variety of tools.

Using large scale numerical computations to solve the equations of QCD (quantum chromodynamics, the theory of the strong force), our lattice QCD group probes the emergence of hadrons and nuclei from quarks and gluons, and seeks to determine important hadronic inputs in searches for physics beyond the Standard Model. These calculations utilize our on-campus cluster computers and also run on the biggest supercomputers in the country. Recent work includes studies of the strong decays of bottom baryons and the first QCD calculation of a nucleus.

We also engage in phenomenological studies of hadrons using tools such as AdS/QCD and other models. Recent work has highlighted the role of two-photon exchange contributions to nucleon form-factors and examined the transverse charge distributions of quarks inside the proton.