

# Garnik Felix Mkrtchian

## Research Institute of Physics

Leading researcher

☎ 23-91  
(060) 71-03-91

✉ mkrтчian@ysu.am



## 🎓 Education

<b>Institution</b>	Yerevan State University
<b>Faculty</b>	Faculty of Physics, Department of Theoretical Physics, Plasma physics
<b>Date</b>	1989 - 1994
<b>Degree name</b>	Qualified specialist

## 🎓 Scientific Rank/degree

<b>Institution</b>	Yerevan State University
<b>Date</b>	2009
<b>Degree name</b>	Doctor
<b>Specialty</b>	Physico-mathematical sciences
<b>Research Topic</b>	Study of some induced processes on electron/ion beams and atoms

## 🌐 Language skills

Հայերեն English Русский

## 📁 Work experience

<b>Institution</b>	Research Institute for Physics, Centre of Strong Fields Physics
<b>Period of time</b>	2015 till now
<b>Rank/degree</b>	Leading researcher

## 🔬 Scientific interests

- Nonlinear electrodynamics of nanostructures; Generation of high harmonics; Non-linear Quantum Electrodynamics; X-ray & gamma lasers

## 🏆 State awards and honorary titles

2003 RA President's Award

## 📖 Publications

Article

**Intense high-order harmonic generation in the giant fullerene molecule C<sub>240</sub>**

H. K. Avetissian, S. Sukiasyan, T. M. Markosyan, G. F. Mkrtchian

Physical Review B 2024 085401

---

Article

**Intense anomalous high harmonics in graphene quantum dots caused by disorder or vacancies**

H. K. Avetissian, G. A. Musayelyan, G. F. Mkrtchian

Physical Review B 2024 085417

---

Article

**Graphene valley polarization as a function of carrier-envelope phase in few-cycle laser pulses and its footprints in harmonic signals**

H. K. Avetissian, V. A. Sedrakyan, Kh. V. Sedrakian, G. F. Mkrtchian

Physical Review B 2023 205403

---

Article

**Disorder-induced effects in high-harmonic generation process in fullerene molecules**

H.K. Avetissian, S. Sukiasyan, H.H. Matevosyan, G.F. Mkrtchian

Results in Physics 2023 106951/8

---

Article

**Long-range correlation-induced effects at high-order harmonic generation on graphene quantum dots**

H. K. Avetissian, A. G. Ghazaryan, Kh. V. Sedrakian, G. F. Mkrtchian

Physical Review B 2023 165410

---

Article

**High-order harmonic generation in three-dimensional Weyl semimetals with broken time-reversal symmetry**

H. K. Avetissian, V. N. Avetisyan, B. R. Avchyan, G. F. Mkrtchian

Physical Review A 2022 033107/1-8

---

Article

**Efficient high-harmonic generation in graphene with two-color laser field at orthogonal polarization**

Hamlet K. Avetissian, Andreas Knorr, Garnik F. Mkrtchian

Physical Review B 2022 195405

---

Article

**Saddle-point exciton signature on high-order harmonic generation in two-dimensional hexagonal nanostructures**

H. K. Avetissian, S. S. Israelyan, H. H. Matevosyan, G. F. Mkrtchian

Physical Review A 2022 063504/1-9

---

Article

**Free-electron nanolaser based on graphene plasmons**

H. K. Avetissian, B. R. Avchyan, H. H. Matevosyan, G.F. Mkrtchian

Laser Physics 2021 055801

---

*Article*

**High harmonic generation in fullerene molecules**

H. K. Avetissian, A. G. Ghazaryan, G. F. Mkrtchian

Physical Review B 2021 125436

---

*Article*

**High-harmonic generation at particle-hole multiphoton excitation in gapped bilayer graphene**

Hamlet K. Avetissian, Ara K. Avetissian, Armenuhi G. Ghazaryan, Garnik F. Mkrtchian,

Khachik V. Sedrakian

Journal of Nanophotonics 2020 026004(1-15)

---

*Article*

**Many-body effects for excitonic high-order wave mixing in monolayer transition metal dichalcogenides**

H. K. Avetissian, G. F. Mkrtchian, K. Z. Hatsagortsyan

Physical Review Research 2020 023072(1-9)

---

*Article*

**Suppression of intervalley exchange coupling in the presence of momentum-dark states in transition metal dichalcogenides**

Malte Selig, Florian Katsch, Samuel Brem, Garnik F. Mkrtchian, Ermin Malic, Andreas Knorr

Physical Review Research 2020 023322(1-17)

---

*Article*

**On the extreme nonlinear optics of graphene nanoribbons in the strong coherent radiation fields**

Hamlet K. Avetissian, Babken R. Avchyan, Garnik F. Mkrtchian, Karine A. Sargsyan

Journal of Nanophotonics 2020 026018(1-9)

---

*Article*

**High laser harmonics induced by the Berry curvature in time-reversal invariant materials**

H. K. Avetissian, G. F. Mkrtchian

Physical Review B 2020 245422

---

*Article*

**Microscopic quantum description of second-order nonlinearities in two-dimensional hexagonal nanostructures beyond the Dirac cone approximation**

H. K. Avetissian, G. F. Mkrtchian, K. G. Batrakov, S. A. Maksimenko

Physical Review B 2020 165406

---

*Article*

**Higher harmonic generation by massive carriers in buckled two-dimensional hexagonal nanostructures**

H. K. Avetissian, G. F. Mkrtchian

Physical Review B 2019 085432(1-10)

---

*Article*

**Wave mixing and high harmonic generation at two-color multiphoton excitation in two-dimensional hexagonal nanostructures**

H. K. Avetissian, A. K. Avetissian, B. R. Avchyan, G. F. Mkrtchian

*Article*

**Theory of second-order excitonic nonlinearities in transition metal dichalcogenides**

Garnik F. Mkrtchian, Andreas Knorr, Malte Selig

Physical Review B 2019 125401(1-14)

---

*Article*

**Impact of electron-electron Coulomb interaction on the high harmonic generation process in graphene**

H. K. Avetissian, G. F. Mkrtchian

Physical Review B 2018 115454(1-9)

---

*Article*

**Multiphoton excitation and high-harmonics generation in topological insulator**

H. K. Avetissian, A. K. Avetissian, B. R. Avchyan, G. F. Mkrtchian

JOURNAL OF PHYSICS-CONDENSED MATTER 2018 185302(1-7)

---

*Article*

**Multiphoton excitation and harmonic generation from the quantum electrodynamic vacuum**

H. K. Avetissian, A. K. Avetissian, B. R. Avchyan, G. F. Mkrtchian

Laser Physics Letters 2018 126003(1-7)

---

*Article*

**High harmonic generation in Landau-quantized graphene subjected to a strong electromagnetic radiation**

Hamlet K. Avetissian, Armenuhi G. Ghazaryan, Garnik F. Mkrtchian, Khachik V. Sedrakian

Journal of Nanophotonics 2017 016004: 1- 9

<https://spie.org/publications/journals/journal-of-nanophotonics>

---

*Article*

**Collective two-boson decay of excitons in a Bose-Einstein condensate and generation of coherent photon-phonon radiation**

H. K. Avetissian, A. K. Avetissian, G. F. Mkrtchian, B. R. Avchyan

Physical Review B 2017 045206/6

<http://journals.aps.org/prb/>

---

*Article*

**Coherent nonlinear optical response of graphene in the quantum Hall regime**

H.K. Avetissian, G.F. Mkrtchian

Physical Review B 2016 045419/7

<http://journals.aps.org/prb/>

---

*Article*

**Enhanced high-order-harmonic generation and wave mixing via two-color multiphoton excitation of atoms and molecules**

H.K. Avetissian, B.R. Avchyan, G.F. Mkrtchian

Physical Review A 2016 013856/7

<http://journals.aps.org/pra/>

---

Article

**Generation of high energy electron and positron beams in solid-plasma-nanolayers under relativistic laser pulses**

H.K. Avetissian, A.K. Avetissian, H.H. Matevosyan, G.F. Mkrtchian, Kh.V. Sedrakian

News and Reports from High Energy Density generated by Heavy Ion and Laser Beams 2015 2016 t2-77

[https://repository.gsi.de/record/194814/files/HEDP\\_report\\_\\_2k15\\_web-version.pdf](https://repository.gsi.de/record/194814/files/HEDP_report__2k15_web-version.pdf)

---

Article

**Nonlinear absorption of high-intensity x-ray radiation in ultradense plasma**

H.K. Avetissian, A.K. Avetissian, A.G. Ghazaryan, H.H. Matevosyan, G.F. Mkrtchian

News and Reports from High Energy Density generated by Heavy Ion and Laser Beams 2015 2016 t2 -78

[https://repository.gsi.de/record/194814/files/HEDP\\_report\\_\\_2k15\\_web-version.pdf](https://repository.gsi.de/record/194814/files/HEDP_report__2k15_web-version.pdf)

---

Article

**Nonlinear response of the quantum Hall system to a strong electromagnetic radiation**

H.K. Avetissian, G. F. Mkrtchian

Physics Letters A 2016 3924-3927

<http://www.journals.elsevier.com/physics-letters-a>

---

Article

**Microscopic nonlinear relativistic quantum theory of absorption of powerful x-ray radiation in plasma**

H. K. Avetissian, A. G. Ghazaryan, H. H. Matevosyan, G. F. Mkrtchian

Physical Review E 2015 043103/8

<https://journals.aps.org/pre/>

---

Article

**Multiphoton interaction of a qutrit with single-mode quantized field in the ultrastrong and deep strong coupling regimes**

H.K. Avetissian, A.K. Avetissian, G. F. Mkrtchian, O.V. Kibis

Journal of Nanophotonics 2015 093064/14

<https://spie.org/publications/journals/journal-of-nanophotonics>

---

Article

**Gamma-ray laser based on the collective decay of positronium atoms in a Bose-Einstein condensate**

H.K. Avetissian, A.K. Avetissian, G. F. Mkrtchian

Physical Review A 2015 023820/10

<http://journals.aps.org/pr/>

---

Article

**Multiphoton dynamics of qutrits in the ultrastrong coupling regime with a quantized photonic field**

H.K. Avetissian, A. K. Avetissian, G.F. Mkrtchian, O.V. Kibis

Journal of Experimental and Theoretical Physics 2015 925-933

<http://link.springer.com/journal/11447>

---

Article

**Production of high energy-solid density electron bunches and hard  $\gamma$ -quanta and positron fluxes by ultrarelativistic lasers in solid-plasma targets**

H.K. Avetissian, H. H. Matevosyan, G. F. Mkrtchian, Kh. V. Sedrakian  
Physical Review Special Topics-Accelerators and Beams 2015 121301/7  
<http://journals.aps.org/prab/about>

---

*Article*

**Multiphoton Excitations and Harmonics Generation in Quantum Electrodynamical Vacuum**

Avetissian H.K., Avetissian A.K., Avchyan B.R., Mkrtchian G.F.

News and Reports from High Energy Density generated by Heavy Ion and Laser Beams 2015 2015 62

[https://repository.gsi.de/record/194814/files/HEDP\\_report\\_\\_2k15\\_web-version.pdf](https://repository.gsi.de/record/194814/files/HEDP_report__2k15_web-version.pdf)

---

*Article*

**Intense Coherent Gamma-Ray Source Based on the Collective Radiation of Positronium Atoms in a Bose-Einstein Condensate**

Avetissian H.K., Avetissian A.K., Mkrtchian G.F.

News and Reports from High Energy Density generated by Heavy Ion and Laser Beams 2015 2015 61

[https://repository.gsi.de/record/194814/files/HEDP\\_report\\_\\_2k15\\_web-version.pdf](https://repository.gsi.de/record/194814/files/HEDP_report__2k15_web-version.pdf)

---

*Conference*

**X-ray Absorption via Electron-ion SB in Maxwellian Plasma at the Exact Consideration of Coulomb Potential**

H.K. Avetissian, A.K. Avetissian, A.G. Ghazaryan, G.F. Mkrtchian

---

*Conference*

**Landau-quantized graphene in strong radiation field and high harmonic generation**

H.K. Avetissian, A.G. Ghazaryan, G.F. Mkrtchian, Kh.V. Sedrakian

---

*Conference*

**Influence of excitonic effects on high harmonic generation by strong laser field in gated graphene**

H.K. Avetissian, G.F. Mkrtchian

---

*Conference*

**Nonlinear response of graphene quantum Hall system to a strong laser radiation**

H.K. Avetissian, G.F. Mkrtchian

---

*Conference*

**Role of Coulomb Forces and Radiation Friction in Laser Production of High Density Electron Beams from Solid-Plasma-Targets**

H.K. Avetissian, S. S. Israelyan, G. F. Mkrtchian, Kh. V. Sedrakian

---

*Conference*

**High harmonics generation with 2D metallic carriers of topological insulators**

H. K. Avetissian, A. K. Avetissian, B. R. Avchyan, G. F. Mkrtchian

---

*Conference*

**High harmonic generation at particle-hole multiphoton excitation in gapped bilayer graphene**

H. Avetissian, A. Avetissian, A. Ghazaryan, G. Mkrtchian, Kh. Sedrakian

---

*Conference*

**High Harmonic Generation in (3+1)-dimensional Weyl Semimetals**

Hamlet Avetissian Karo, Vagharshak Avetisyan Narek, Babken Avchyan Ruben, Garnik Mkrtchian Felix

---

*Conference*

**Disorder-Induced Effects in High-Harmonic Generation Process in Fullerene Molecules**

H. K. Avetissian, S. Sukiasyan, H. H. Matevosyan, G. F. Mkrtchian

---