



The Canadian VERITAS Group

Faculty: Ken Ragan, David Hanna, (Nahee Park)
Post-docs: Stephan O'Brien, Sajan Kumar
Students: Julia Lascar (MSc), Matthew Lundy (MSc)

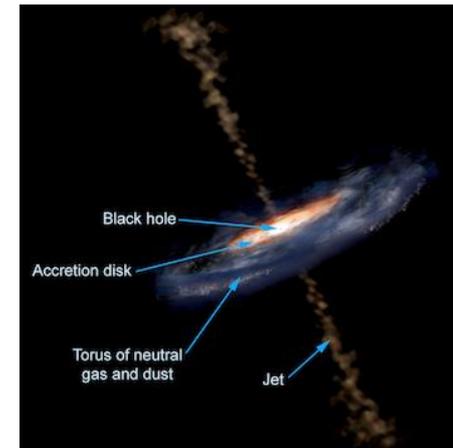
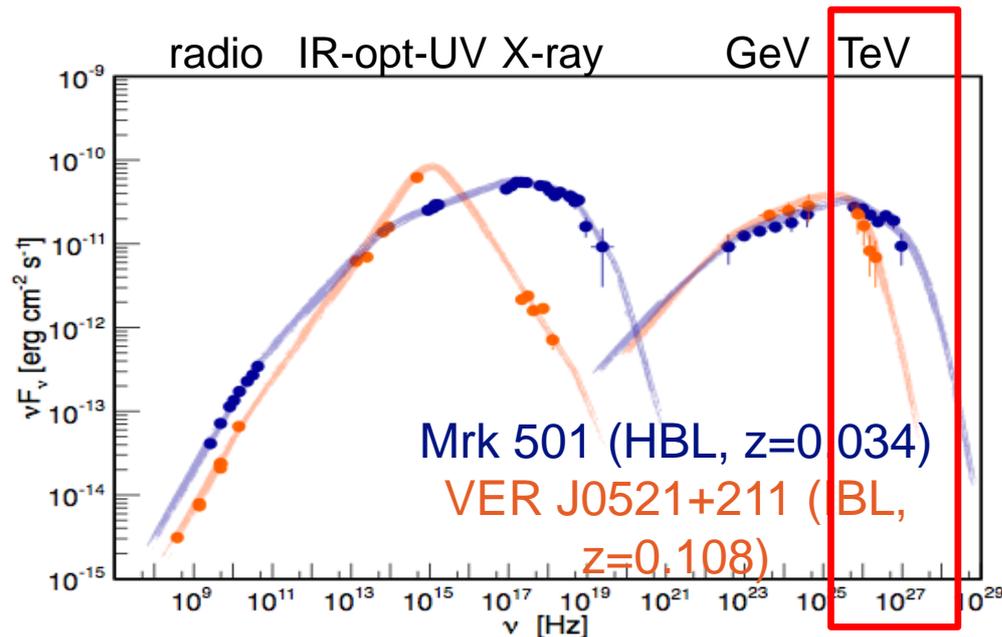
K. Ragan
IPP Town Hall
July 2020



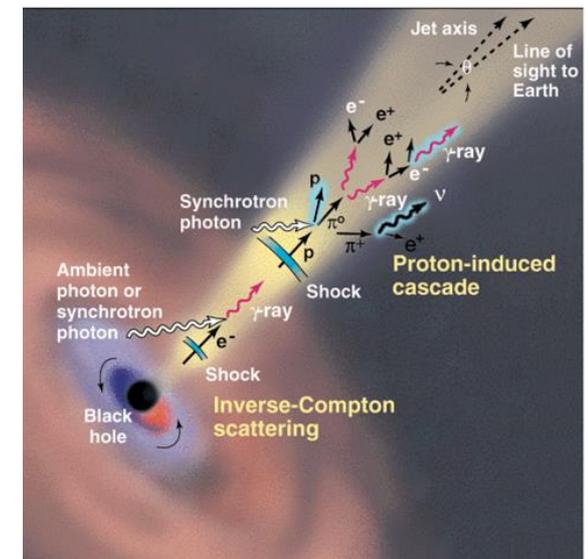
McGill

The Science:

- VERITAS observes very-high energy* (VHE, $E > 100$ GeV) photons*
- In many objects, VHE regime dominates energy (EM) output

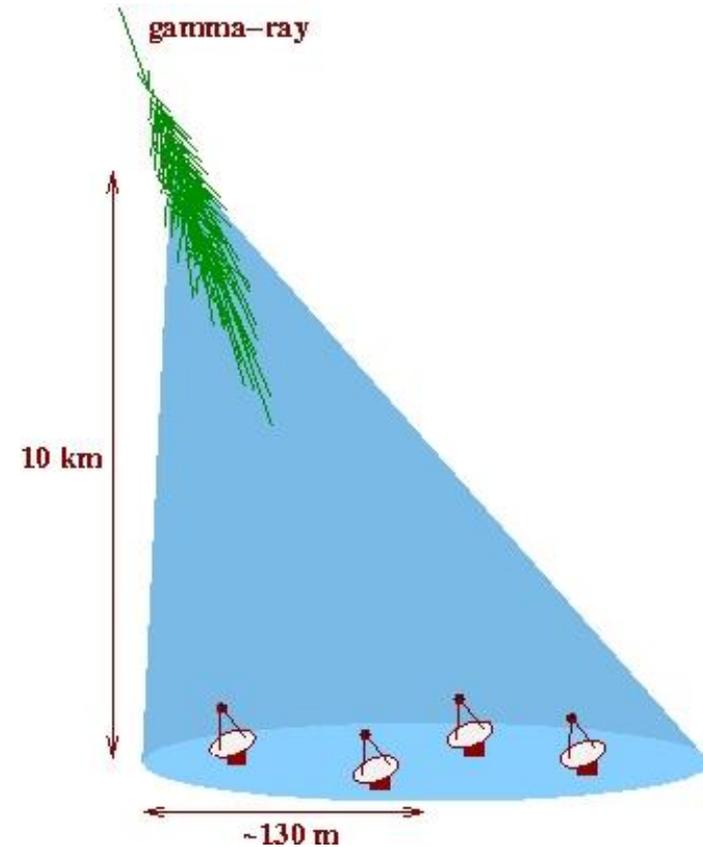
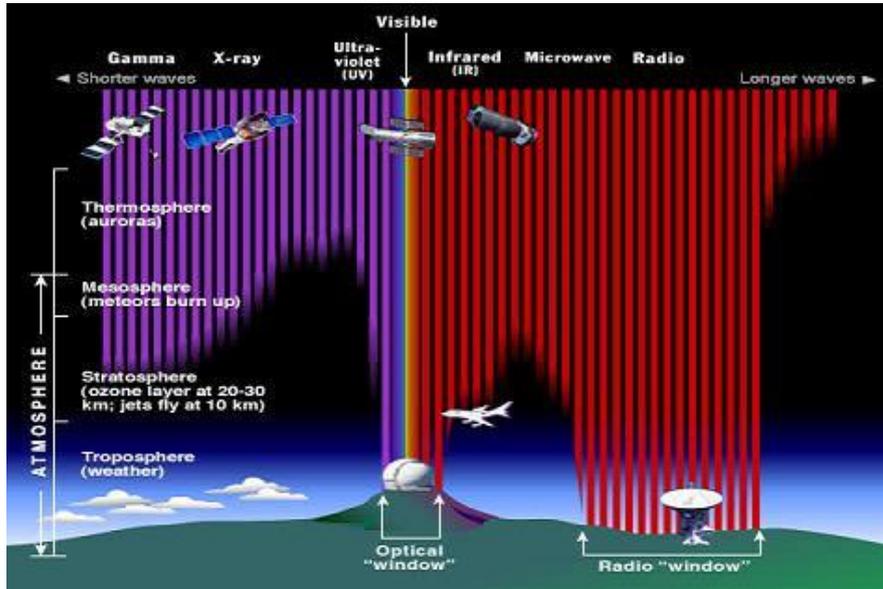


- Understanding the VHE regime (in tandem with the GeV regime) helps to unravel the operation of these objects
- >100 GeV photons \rightarrow charged particles with $E > \sim$ TeV – how does *that* happen?



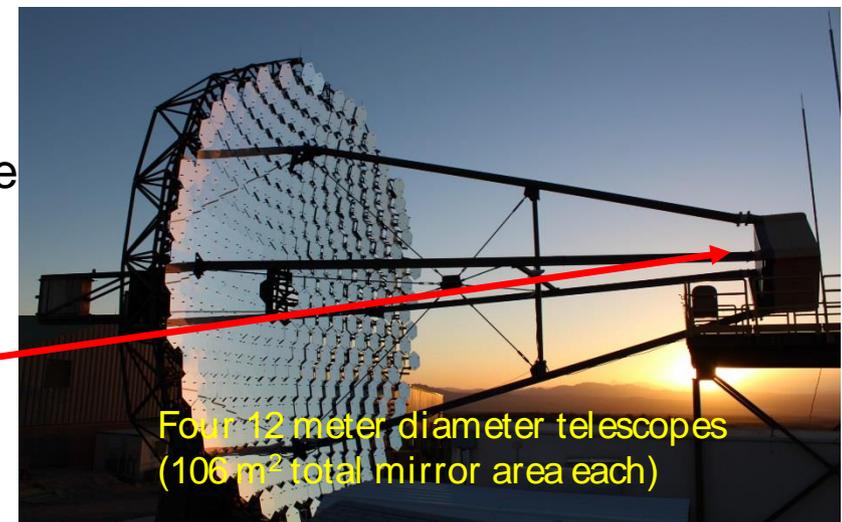
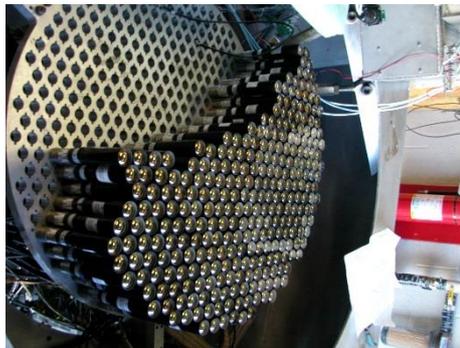
The problem/opportunity:

- Hard to do this from the ground ...
- Can't do this with "normal" astronomical instruments ...



- Use the atmosphere as part of the detector
- Use particle physics instrumentation, technique and approaches

Camera of photomultiplier tubes (here: 1/2 populated)



At McGill, our interests are primarily the astroparticle connections, eg:

- dark matter searches eg. PRD 95, 082001 (2017)
- very high energy e^+/e^- spectrum eg. PRD 98, 062004 (2018)
- Lorentz-invariance-violation searches
- transient followups (optically, and at VHE energies):
 - GRB and FRB follow-ups eg. ApJ 857, 33 (2018),
ApJ 795, L3 (2014)
 - IceCube HE neutrino correlations eg. Science 361, eaat1378 (2018)
A&A 607, 115 (2017)
 - LIGO follow-ups

Brief history and current status of the experiment:

- VERITAS has been in full operation since 2007, including Canadian hardware components
- McGill group has provided a steady stream of instrumental (calibration) & analysis tools
- McGill group has historically been one of the bigger groups in the collaboration (now: 6 people out of ~65)
- US funding (SAO, NSF, DOE) assured through Fall 2022
- NSERC project funding granted through March 2023.
- Discussion within collaboration about possible short-term (~2-3 years) and longer-term upgrades

Brief answers to specific elements of the IPP LRP request

1) Plans for 2022-2027

- VERITAS (McGill) is funded through March 31, 2023
- Group size is stable (2 PIs(*), 2 post-docs, 2 students) and we will continue to participate fully, ie:
 - observations, incl. calibration & operations
 - analyses with strong astroparticle flavor
 - participation in governance (TAC, SWGs, Science Board, Executive Committee)
- Participation in any possible upgrades has not yet been decided
- We do not foresee major equipment, CFI, computing or infrastructure requirements
- For purposes of this LRP cycle, can assume that VERITAS Canada will be ramping down by mid-2020's

Brief answers to specific elements of the IPP LRP request

2) EDI

- We build on strong EDI commitments by McGill, by McGill physics, and by VERITAS
- At the department level, we have an active EDI group that meets weekly, and are adopting a values statement and code of conduct that privilege equity and diversity. We encourage participation in these activities.
- VERITAS has many women role models including past spokespeople, SWG leaders, TAC chairs, etc.
- Our own (PIs') record of female HQP numbers is slightly above departmental average

Brief answers to specific elements of the IPP LRP request

3) Plans for 2028-2036

None. See above, under 1), 5th bullet point.

4) Societal impact

- Like most of SAP, our primary societal impacts are:
 - Knowledge, as measured by publications, theses, presentations
 - Outreach – incl. “MuonHunter” on zooniverse
 - HQP; Over 10 years we have worked with:
 - >> 10 undergrads
 - 7 PhDs, 10 MSc students
 - 7 PDFs, RAs

Alumni include faculty, national lab staff, data scientists, and employees of tech and financial companies