Informing the Public on Light Pollution

KE Lunch Meeting
2013 October 11, 2013

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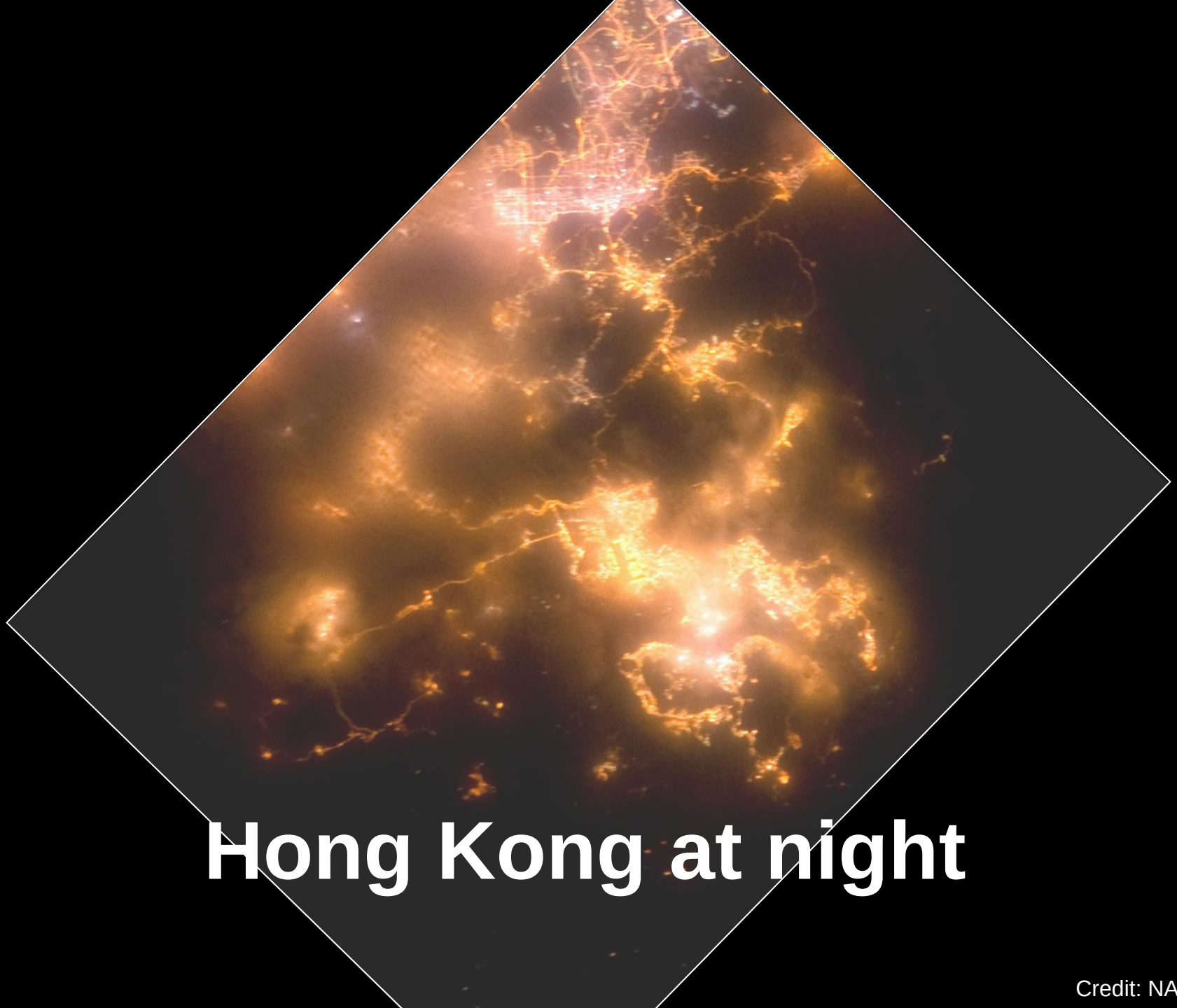
Department of Physics

http://nightsky.physics.hku.hk

Can you guess what it is?



Hong Kong at night

Credit: NASA

Outline

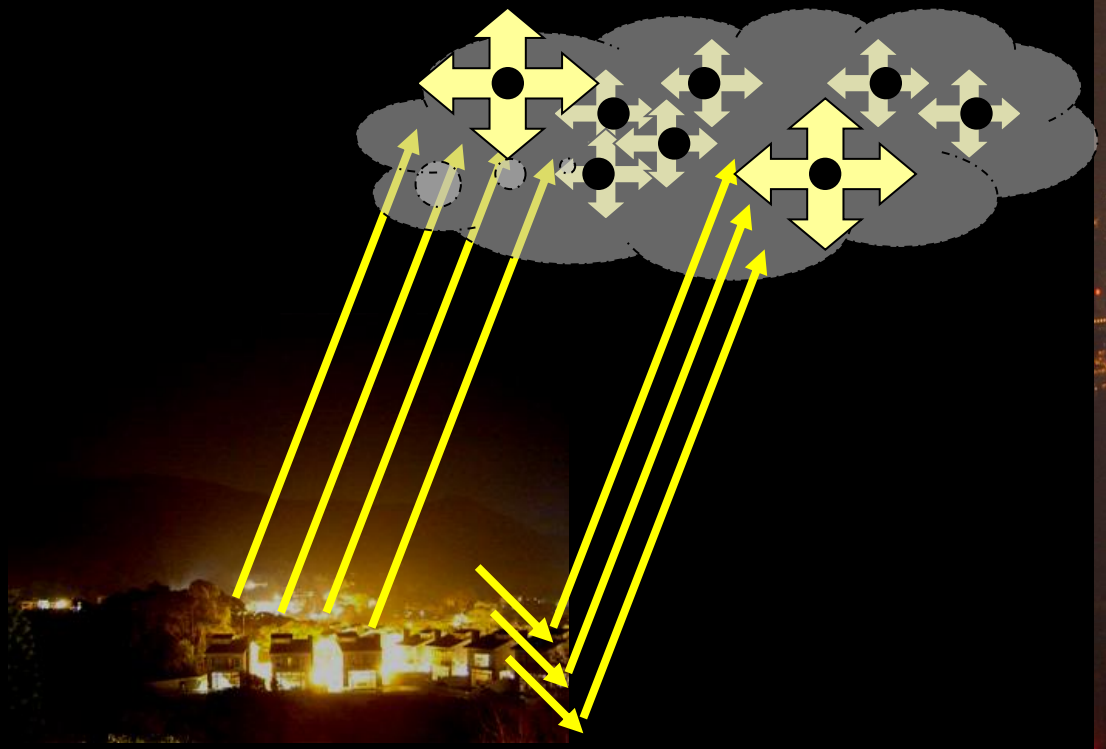
- Light pollution: What is it? Why do we care?
- Light pollution: How to measure it?
- Knowledge Exchange Fund for Impact Project 2012
- Communicating with the public on light pollution:
  - Secondary school teachers / students
  - Environmental community
  - Media
  - Government
  - General public
- Looking ahead: Sustaining the efforts

Poorly-designed
artificial light sources

Excessive artificial
outdoor lightings

Light Pollution

- Light Pollution is the improper use of artificial outdoor lightings which leads to adverse effects on the environment.
- Wasteful light emitted upwards directly by or reflected from artificial sources being scattered by aerosol (cloud, fog), or pollutants like suspended particulates in the atmosphere.



Adverse effects of light pollution

- **Health**: light trespass, light nuisance
- **Environmental**: nocturnal species, unbalance ecological systems
- **Astronomical**: skyglow / “overglow” from urban lighting
- **Energy**: light not targeted at your eyes → wasted energy

A dark night sky as a common treasure that should be shared by all humans on Earth

Measuring light pollution

- **Greensense (環保觸覺)**: Measure with a lux-meter, counting the number of signboards
- **Friends of Earth (地球之友)**: Invited the general public to report abusive lighting.
- **GLOBE @ night**: counting of number of stars visible at the Orion constellation

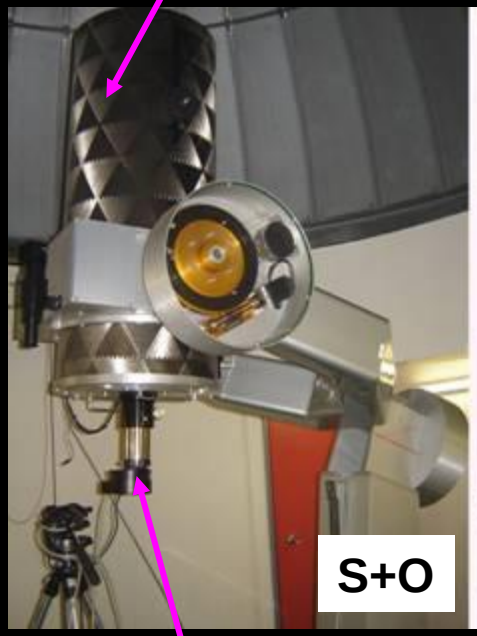
Measuring light pollution: night sky brightness

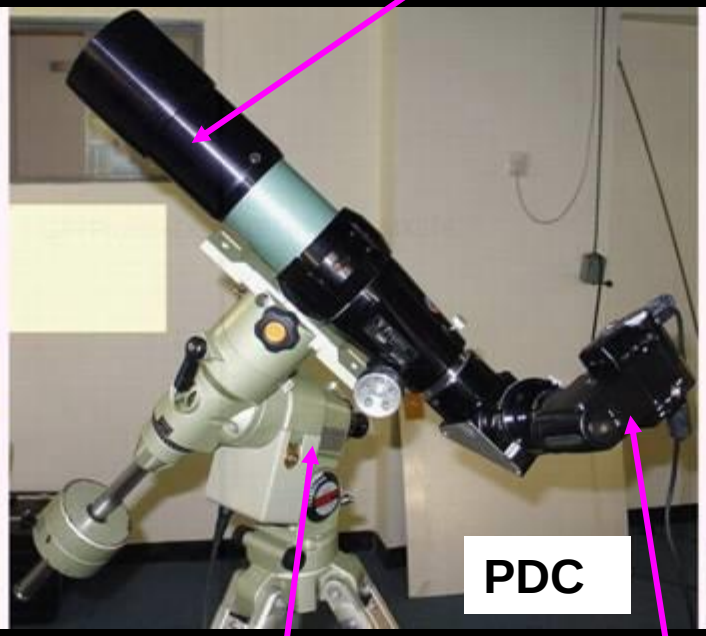
- Astronomical technique (2003 – 2011)

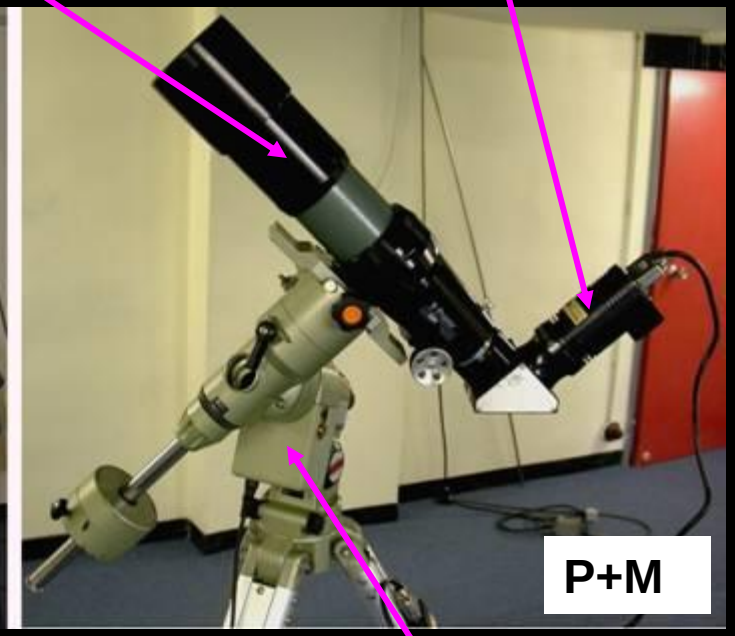
16” f/5.7 OGS RC telescope

70mm f/6.8 TeleVue Pronto refracting telescope + 2” diagonal

2” V-band filter + Starlight Xpress MX916 CCD







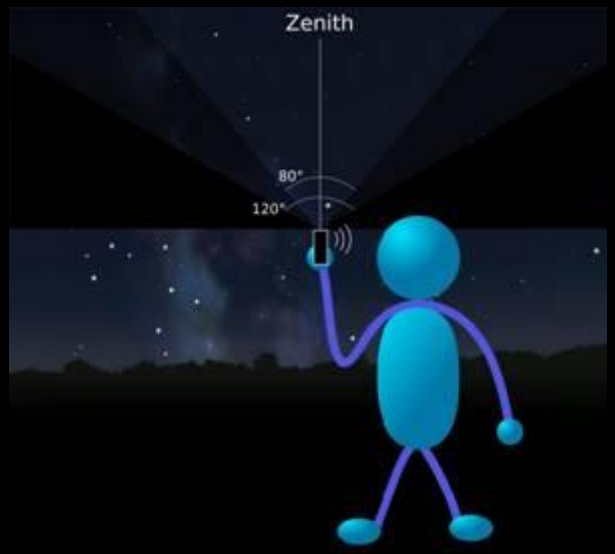
2” V-band filter + focal reducer + SBIG ST8 CCD

GP equatorial mount

eyepiece adapter + 1.25” V-band filter + Nikon Coolpix 4500 DC

GP equatorial mount

Measuring light pollution: night sky brightness



- **Sky Quality Meter**
  - portable meter for measuring sky brightness
  - precision ~±10%
  - ~US$ 250
  - Results in units of **magnitude per square arcsecond (mag/arcsec^2)**
  - **A smaller reading means a brighter measurement**

From: http://unihedron.com/projects/darksky/

香港特別行政區政府 HKSAR Government
環境及自然保育基金
Environment and Conservation Fund

香港大學 The University of Hong Kong
物理系 Department of Physics

First Phase (2008.3.15-2008.5.31)
Briefing Session

http://nightsky.physics.hku.hk

Launched ***A Survey of Light Pollution in Hong Kong*** **(香港光害調查)** with the support of the Environment and Conservation Fund (ECF) of the Government in Nov 2007

A Survey of Light Pollution in Hong Kong

- Assisting organizations:
  - Hong Kong Space Museum
  - Ho Koon Nature Education cum Astronomical Centre
  - The Camping Association of Hong Kong, China, Ltd
  - The Sky Observers' Association (Hong Kong)
- Invited secondary school students to participate (148 students from 28 schools)
- **Volunteers** reported measurements through web-based interface

Briefing session for participating students

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A Citizen Science Project

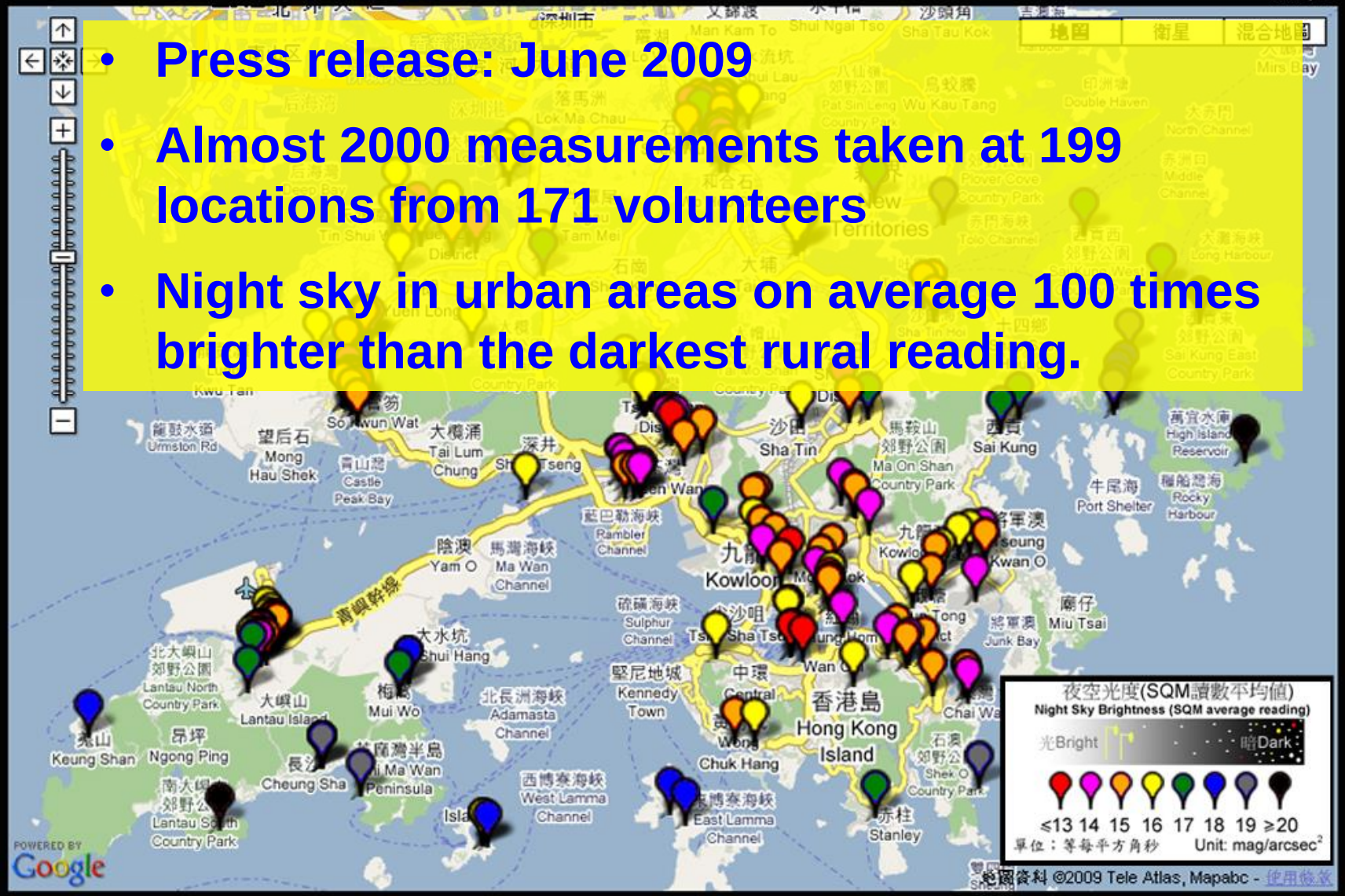
Briefing session for participating students

香港大學物理學系 香港光害調查 A Survey of Light Pollution in Hong Kong, Department of Physics, HKU

香港夜空光度分佈圖 Hong Kong Light Pollution Map

09年6月
June, 09

- **Press release: June 2009**
- **Almost 2000 measurements taken at 199 locations from 171 volunteers**
- **Night sky in urban areas on average 100 times brighter than the darkest rural reading.**



Results published in Environment Monitoring and Assessment (2012) 184: 2537-2557

http://www.springerlink.com/content/08814311727512q4/

Environ Monit Assess (2012) 184:2537–2557
DOI 10.1007/s10661-011-2136-1

Night-sky brightness monitoring in Hong Kong

A city-wide light pollution assessment

Chun Shing Jason Pun · Chu Wing So

Received: 2 September 2010 / Accepted: 25 May 2011 / Published online: 29 June 2011
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Abstract Results of the first comprehensive light pollution survey in Hong Kong are presented. The night-sky brightness was measured and monitored around the city using a portable light-sensing device called the Sky Quality Meter over a 15-month period beginning in March 2008. A total of 1,957 data sets were taken at 199 distinct locations, including urban and rural sites covering all 18 Administrative Districts of Hong Kong. The sur-

and/or environmental factors. Moreover, earlier night skies (at 9:30 p.m. local time) are generally brighter than later time (at 11:30 p.m.), which can be attributed to some public and commercial lightings being turned off later at night. On the other hand, no concrete relationship between the observed sky brightness and air pollutant concentrations could be established with the limited survey sampling. Results from this survey will

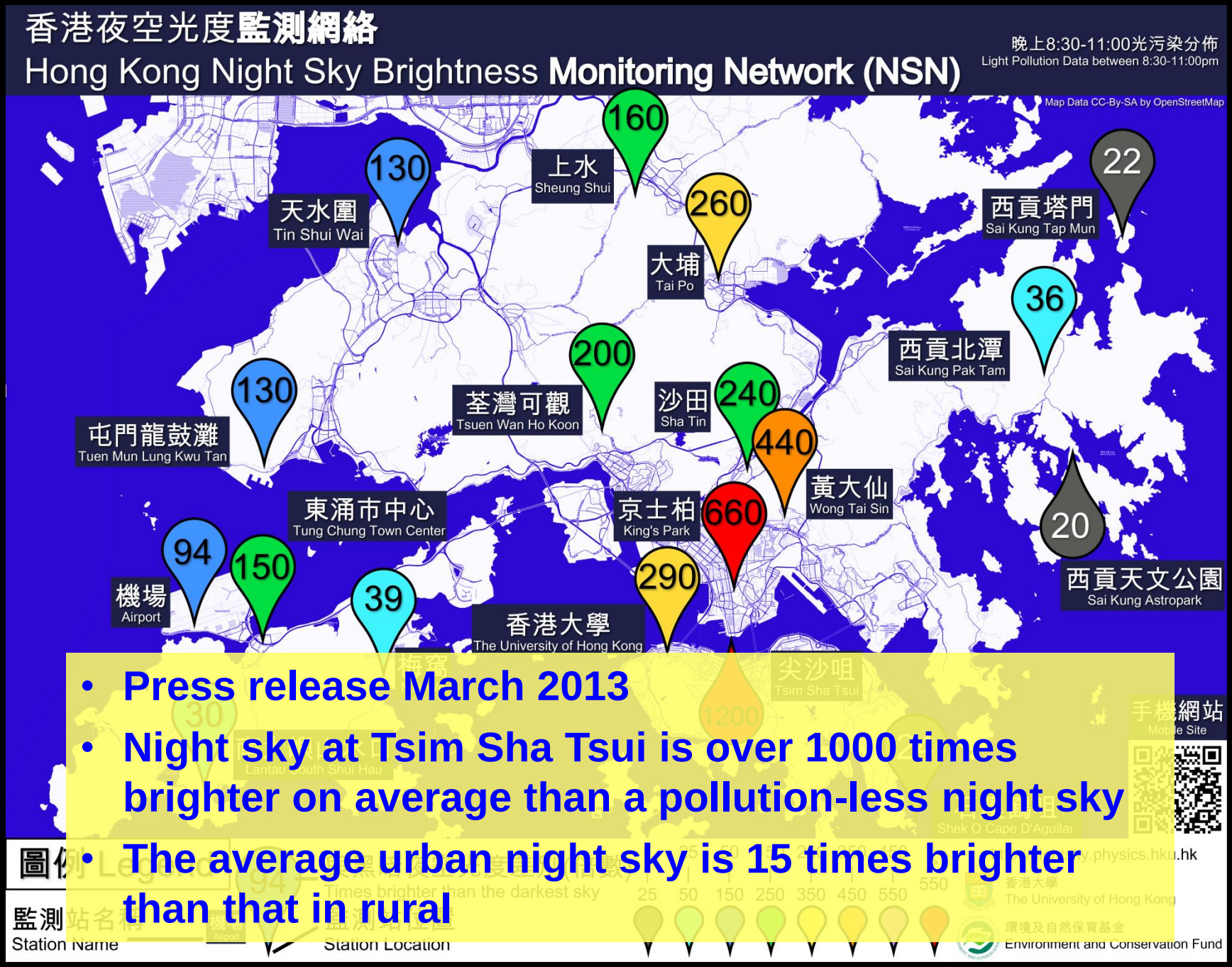
Measuring light pollution: night sky brightness

- Launched the ***Hong Kong Night Sky Brightness Monitoring Network* (*NSN*) (香港夜空光度監測網絡)** with the support of another ECF in June 2010

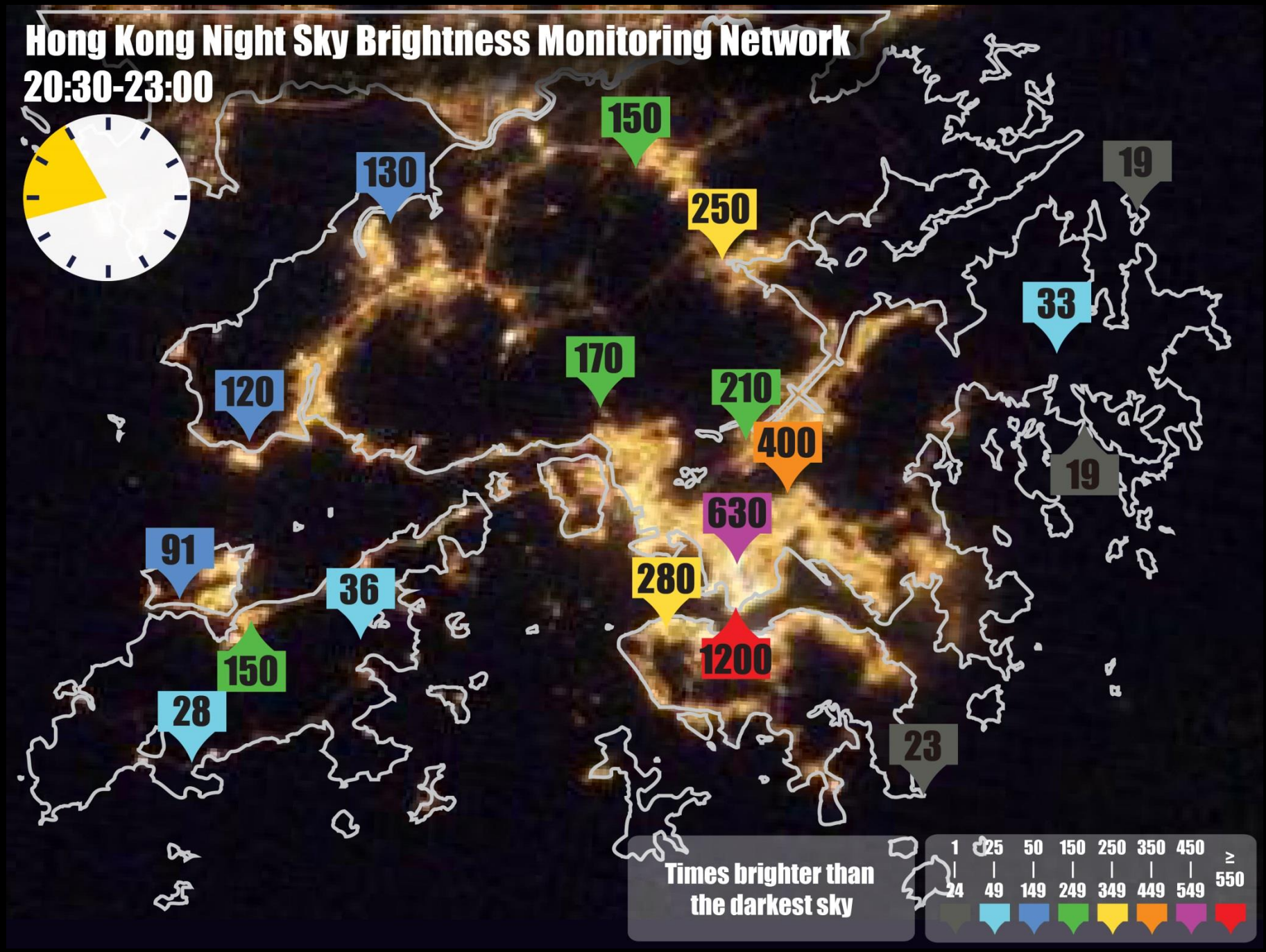
- Co-organizers: Hong Kong Space Museum, Hong Kong Observatory, Hokoon Nature Education cum Astronomy Centre

Measuring light pollution: night sky brightness

- Internet-ready version of the SQM installed in 18 locations for **automatic and continuous** measurements
- **Real-time** release of results over to the Internet.
- **Five million individual night sky measurements collected**.



- **Press release March 2013**
- **Night sky at Tsim Sha Tsui is over 1000 times brighter on average than a pollution-less night sky**
- **The average urban night sky is 15 times brighter than that in rural**


Hong Kong Night Sky Brightness Monitoring Network
20:30-23:00
150
130
250
19
33
170
120
210
400
19
630
91
36
280
150
1200
28
23
Times brighter than the darkest sky
1 | 24
25 | 49
50 | 149
150 | 249
250 | 349
350 | 449
450 | 549
≥ 550

KE Funding for Impact Project

- KE Funding for Impact Project 2012/13 "Community Light Pollution Reach-out Project" ($100,000)
- Co-investigators: Faculty of Science, HoKoon Nature Education cum Astronomy Centre
- **Objectives**:
  - To promote the results from the Hong Kong light pollution study conducting in HKU to the public;
  - To educate school students and the general public the science and environmental impacts of light pollution;
  - To engage the community with light pollution research.
- **Two components**:
  1. Secondary school program
  2. High impact signature event (Science Roadshow)

Community Light Pollution Reach-out: School program

- Organized workshops for 4 secondary schools
- Rundown of the workshop:
  - Lecture;
  - Measurement workshop;
  - Portable-dome observation
  - Exhibition
  - Student research

Community Light Pollution Reach-out: Science Roadshow

- **Co-organized with the Faculty of Science Outreach Team**
- Science Roadshow at the Avenue of during Earth Hour 2013 organized by WWF
- Contents of the Roadshow:
  1. Real-time nights sky measurements;
  2. Demonstrations;
  3. Video presentations;
  4. Panel exhibitions

Community Light Pollution Reach-out: Science Roadshow

We acknowledge the Felix So Photography Alumni Association http://www.fspaa.org.hk/ for volunteering photography of the event.

Communicating with the public on light pollution

A big challenge in a city deeply proud of her identity as the *bright* "Pearl of the Orient"

Communicating with the public on light pollution (some personal thoughts)

- **Secondary School teachers and students:**
  - Open to new ideas (particularly for students)
  - Teachers and students are extremely busy!
  - ***Independent Enquiry Study*** of Liberal Studies curriculum
  - Engagement of teachers essential
- **Challenges:**
  - Engaging students and teachers for an extended duration, and for deeper impact projects
  - Extending our “core outreach group” from astronomy teachers to liberal studies teachers

Communicating with the public on light pollution (some personal thoughts)

- **Environmental community:**
  - Enthusiasm and dedication
  - Knowledge and experience with media
  - Appreciative of scientific inputs
  - Generate synergy

- **Challenges:**
  - Striking balance between objective scientific positions and advocacy

Press conference organized by Friends of Earth in 2009 on Lights-out campaign

Communicating with the public on light pollution (some personal thoughts)

- **Stakeholders in the community:**
  - Delivered 1 to 1.5 hour lectures for professional bodies, e.g.
    - The Hong Kong Institute of Housing 香港房屋經理學會
    - The Hong Kong Institute of Surveyors 香港測量師學會, …….
  - Continuing Professional Development (CPD) point-earning
  - Practical concerns from professionals on the ground

- **Challenges:**
  - Learn the roles of various professionals in the community
  - Learn the “language” of the different communities

Communicating with the public on light pollution (some personal thoughts)

- **Media:**
  - Light pollution a new issue when we started
  - 80 newspaper/webpage reports, 20 TV/radio appearances
  - Usually sympathetic of our concerns and willing to listen
  - Fast-thinking and efficient in learning new ideas and concepts

Communicating with the public on light pollution (some personal thoughts)

- **Challenges:**
  - Explaining quantitative and logically complex arguments
  - It was a struggle to explain "*The night sky in Tsim Sha Tsui is 1000 times brighter than the dark standard*."
  - Unique to us: A difficult unit to understand! (mag/arcsec^2)
  - Schedule: newspaper reporters usually complete their articles after 6pm (prepare for phone calls)
  - **Needs to be very careful with all information released**.

Communicating with the public on light pollution (some personal thoughts)

- **Government:**
  - First two projects on light pollution ever funded by Environmental Protection Department (EPD).
  - Huge help from the co-organizers of the project: Hong Kong Space Museum and Hong Kong Observatory
  - Installed our equipment within government properties
  - Experience of working with officials really varied

- **Challenges:**
  - Extending the core audience from EPD to other government agencies who had a stake in the issue

Communicating with the public on light pollution (some personal thoughts)

- **General Public:**
  - Talks, talks, and more talks… : Space Museum, community weather network, private corporation
  - Our webpage provides the interface to communicate educational materials and research results to the public.
  - ***Google analytic*** provided a means to measure the effectiveness of the responses

- **Challenges:**
  - Communicating with skeptical segments of the public
  - Maintaining the momentum

Looking forward

- KE Funding for Impact Project 2013/14 “Light Pollution Awareness Community Engagement Project” ($100,000)
- Objective:
  - To engage the environmental community on the adverse impacts of light pollution
  - To engage secondary school students to conduct light pollution studies in their local surroundings
  - To promote measures to reduce the extent of light pollution in both ecologically sensitive rural areas and in urban communities
- HKSAR government consultation paper: *Task Force on External Lighting Document for Engaging Stakeholders and the Public* (Deadline Nov 18) http://www.enb.gov.hk/external_lighting/

Acknowledgement

- I would like to thank partners in these KE efforts:
  - Mr Chu Wing So, Wai Yan Leung, Chung Fai Leung (HKU Physics)
  - Mr Sze-Leung Cheung (HKU Science Faculty)
  - Mr Ho Keung Kenneith Hui (HoKoon Nature Education cum Astronomical Centre)

- Check out our webpage for more information: http://nightsky.physics.hku.hk

- Email: jcspun@hku.hk