

กำหนดการโครงการ IF School

วันที่ 19 – 31 พฤษภาคม 2568

ณ วิทยาลัยเพื่อการค้นคว้าระดับรากฐาน มหาวิทยาลัยนเรศวร

วันจันทร์ ที่ 19 พฤษภาคม 2568

- 08:00 – 08:20 น. ลงทะเบียน
- 08:20 น. พิธีเปิดโครงการ โดย ผู้อำนวยการวิทยาลัยเพื่อการค้นคว้าระดับรากฐาน
- 08:30 น. กล่าวต้อนรับโดยผู้สนับสนุนโครงการฯ ต่างๆ
- 09:00 น. ถ่ายภาพร่วมกัน

ตารางการเรียนการสอน 19 – 31 พฤษภาคม 2568

| Week 1           | Morning          |                  |  | Afternoon            |               |  | Night            |
|------------------|------------------|------------------|--|----------------------|---------------|--|------------------|
| 19 – 25 May 2025 | 8.30 - 10.00     | 10.30 - 12.00    |  | 13.30 - 15.00        | 15.30 - 17.00 |  | 18.30 - 20.00    |
| Monday           | Opening Session  | M1 (SV)          |  | M2 (SV)              | M2 (SV)       |  | TM1-2 (SV)       |
| Tuesday          | M3 (SY)          | M3 (SY)          |  | M4 (SY)              | M4 (SY)       |  | TM3-4 (TK)       |
| Wednesday        | G1 (PW)          | G1 (PW)          |  | C1 (TC)              | C1 (TC)       |  | TG1 (CC)         |
| Thursday         | Q11 (ND)         | Q11 (ND)         |  | Q12 (ND)             | Q12 (ND)      |  | TQ11-2 (MO & AJ) |
| Friday           | G2 (PW)          | G2 (PW)          |  | C2 (TC)              | C2 (TC)       |  | TC1-2 (SJ & JS)  |
| Saturday         | Seminar 1 (QTFT) | Seminar 2 (QTFT) |  | Special Short Course |               |  |                  |
| Sunday           | Free Day         |                  |  |                      |               |  |                  |

| Week 2           | Morning      |                   | Afternoon         |                | Night               |
|------------------|--------------|-------------------|-------------------|----------------|---------------------|
| 26 - 31 May 2025 | 8.30 - 10.00 | 10.30 - 12.00     | 13.30 - 15.00     | 15.30 - 17.00  | 18.30 - 20.00       |
| Monday           | FT1 (PV)     | FT1 (PV)          | FT2 (PV)          | FT2 (PV)       | TFT1-2<br>(SJ & AP) |
| Tuesday          | G3 (PW)      | G3 (PW)           | C3 (KK)           | C3 (KK)        | TG2-3 (CC)          |
| Wednesday        | FT3 (PS)     | FT3 (PS)          | FT4 (PS)          | FT4 (PS)       | TFT3-4 (AY)         |
| Thursday         | Q13 (ND)     | Q13 (ND)          | Q14 (ND)          | Q14 (ND)       | TQ13-4 (MO & AJ)    |
| Friday           | G4 (PW)      | G4 (PW)           | C4 (KK)           | C4 (KK)        | TC3-4 (SJ & JS)     |
| Saturday         |              | Seminar 3 (KMITL) | Seminar 4 (-TBA-) | Seminar 5 (IF) |                     |

## รายละเอียดรายวิชา

| Maths                                      | คณิตศาสตร์ by Salvatore De Vincenzo (SV) & Sikarin Yoo-Kong (SY)              |
|--------------------------------------------|-------------------------------------------------------------------------------|
| <b>M1</b><br>Salvatore De Vincenzo (SV)    | Linear Spaces, Examples, Spectral Decomposition                               |
| <b>M2</b><br>Salvatore De Vincenzo (SV)    | Fourier Series, Fourier Transform, Dirac's delta, Distributions               |
| <b>M3-M4</b><br>Sikarin Yoo-Kong (SY)      | Complex analysis (Cauchy theorem and residue, conformal mapping, branch cuts) |
| <b>TM1-2</b><br>Salvatore De Vincenzo (SV) | Tutorial for linear algebra, Fourier transform                                |
| <b>TM3-4</b><br>Thanadon Kongkoom (TK)     | Tutorial for complex analysis                                                 |

| GR and black holes                 | ทฤษฎีสัมพัทธภาพทั่วไป และหลุมดำ                                        |
|------------------------------------|------------------------------------------------------------------------|
| <b>G1</b><br>Pitayuth Wongjun (PW) | From classical mechanics to special relativity, Minkowski spacetime    |
| <b>G2</b><br>Pitayuth Wongjun (PW) | Equivalent principle, tensor, parallel transport, curvature            |
| <b>G3</b><br>Pitayuth Wongjun (PW) | Energy momentum tensor, Einstein field equation                        |
| <b>G4</b><br>Pitayuth Wongjun (PW) | Black hole solutions, singularity, spacetime diagram.                  |
| <b>TG1</b><br>Chun-Hung Chen (CC)  | Exercise on vector calculus in Minkowski spacetime                     |
| <b>TG2</b><br>Chun-Hung Chen (CC)  | Exercise on vector calculus in curved spacetime and geodesic equation. |

| Cosmology                                                            | จักรวาลวิทยา                                                                                                                    |
|----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>C1</b><br>Teeraparb Chantavat (TC)                                | Cosmological principle, Hubble's law, Friedmann's equation, Acceleration equation, Geometry of the universe                     |
| <b>C2</b><br>Teeraparb Chantavat (TC)                                | Observational Cosmology, Correlation functions, Large-scale structure                                                           |
| <b>C3</b><br>Khamphee Karwan (KK)                                    | Distance in cosmology, Evolution of different components of the universe, different model of the universe, LambdaCDM model, CMB |
| <b>C4</b><br>Khamphee Karwan (KK)                                    | Inflationary universe + modified gravity                                                                                        |
| <b>TC1-2</b><br>Sakdithut Jitpienka (SJ) &<br>Jakkrit Sangtawee (JS) | Tutorial for C1 and C2                                                                                                          |
| <b>TC3-4</b><br>Sakdithut Jitpienka (SJ) &<br>Jakkrit Sangtawee (JS) | Tutorial for C3 and C4                                                                                                          |

| Quantum information                                                          | สารสนเทศเชิงควอนตัม                           |
|------------------------------------------------------------------------------|-----------------------------------------------|
| <b>QI1</b><br>Ninnat Dangniam (ND)                                           | Information entropy, linear algebra           |
| <b>QI2</b><br>Ninnat Dangniam (ND)                                           | Qubit, quantum nonlocality                    |
| <b>QI3</b><br>Ninnat Dangniam (ND)                                           | Density operator and entanglement measures    |
| <b>QI4</b><br>Ninnat Dangniam (ND)                                           | Generalized measurement, open quantum systems |
| <b>TQI1-2</b><br>Matachan Oupatam (MO) &<br>Atichat Jaruphattharaphanit (AJ) | Tutorial for QI1 and QI2                      |
| <b>TQI3-4</b><br>Matachan Oupatam (MO) &<br>Atichat Jaruphattharaphanit (AJ) | Tutorial for QI3 and QI4                      |

| Field theory                                  | ทฤษฎีสนาม                                                 |
|-----------------------------------------------|-----------------------------------------------------------|
| <b>FT1</b><br>Pichet Vanichchapongjaroen (PV) | Lagrangian and Hamiltonian for systems of point particles |
| <b>FT2</b><br>Pichet Vanichchapongjaroen (PV) | Classical free scalar field theory                        |
| <b>FT3</b><br>Pongwit Srisangyingcharoen (PS) | Canonical quantization of free scalar field               |
| <b>FT4</b><br>Pongwit Srisangyingcharoen (PS) | Dirac field theory and its quantization                   |
| <b>TFT 1-2</b><br>Aphiwat Yuenyong (AY)       | Tutorial for Field theory 1-2                             |
| <b>TFT 3-4</b><br>Aphiwat Yuenyong (AY)       | Tutorial for Field theory 3-4                             |

|                      |                                                                  |
|----------------------|------------------------------------------------------------------|
| Special Short Course | -TBA-                                                            |
|                      | ดร.อภิสิทธิ์ อึ้งกิจจานุกิจ ภาควิชาฟิสิกส์ จุฬาลงกรณ์มหาวิทยาลัย |