

UM-SJTU PHYSICS LABORATORY  
DATA SHEET (EXERCISE 4)

Name: Han Yibei

Student ID: 59370710123

Name: Lu Xinyi

Student ID: 59370710122

Group: 11

Date: 11.6

NOTICE. Please remember to show the data sheet to your instructor before leaving the laboratory. The data sheet will not be accepted if the data are recorded with pencil or modified by correction fluid/tape. If a mistake is made in recording a datum item, cancel the wrong value by drawing a fine line through it, record the correct value legibly, and ask your instructor to confirm the correction. Please remember to take a record of the precision of the instruments used. You are required to hand in the original data with your lab report, so please keep the data sheet properly.

Uncertainty of  $\theta$  is ~~0.5~~ 2

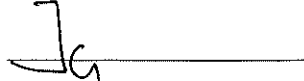
| Maximum Electric Current $I_0$ |                               |          |                               |
|--------------------------------|-------------------------------|----------|-------------------------------|
| $\theta$                       | $I [\mu A] \pm 0.001 [\mu A]$ | $\theta$ | $I [\mu A] \pm 0.001 [\mu A]$ |
| 0°                             | <del>0.451</del> 0.728        | 50°      | <del>0.284</del> 0.317        |
| 5°                             | <del>0.650</del> 0.728        | 55°      | <del>0.227</del> 0.253        |
| 10°                            | <del>0.628</del> 0.715        | 60°      | <del>0.190</del> 0.192        |
| 15°                            | <del>0.618</del> 0.690        | 65°      | <del>0.127</del> 0.141        |
| 20°                            | <del>0.587</del> 0.661        | 70°      | <del>0.084</del> 0.095        |
| 25°                            | <del>0.550</del> 0.612        | 75°      | 0.057                         |
| 30°                            | <del>0.504</del> 0.555        | 80°      | <del>0.021</del> 0.025        |
| 35°                            | <del>0.452</del> 0.501        | 85°      | <del>0.009</del> 0.008        |
| 40°                            | <del>0.401</del> 0.446        | 90°      | 0.000                         |
| 45°                            | <del>0.342</del> 0.380        |          |                               |

Table 1. Measurement data Malus' law demonstration.

Instructor's signature: \_\_\_\_\_

| Rotation angle of the 1/2-wave plate | Rotation angle of the analyzer [°] $\pm$ [2]° |
|--------------------------------------|---|
| initial                              | <del>0</del> 0                                |
| 10°                                  | 20  |
| 20°                                  | 40  |
| 30°                                  | 60  |
| 40°                                  | 82  |
| 50°                                  | 101   |
| 60°                                  | 121   |
| 70°                                  | 143 / 142                                     |
| 80°                                  | 162   |
| 90°                                  | 181   |

Table 2. Measurement data for the 1/2-wave plate.

Instructor's signature: 

| Rotation angle of 1/4-wave plate: 0° |                                    |                        |                              |
|--------------------------------------|------------------------------------|------------------------|------------------------------|
| Maximum Electric Current $I_0$       |                                    | $0.500 \pm 0.001$ [mA] |                              |
| $\theta$                             | $I$ [mA] $\pm 0.001$ [mA]          | $\theta$               | $I$ [mA] $\pm 0.001$ [mA]    |
| 0°                                   | 0.000 0.485                        | 180°                   | 0.000 0.499                  |
| 10°                                  | 0.015 0.473                        | 190°                   | 0.016 0.480                  |
| 20°                                  | 0.052 0.428 <del>0.457 0.428</del> | 200°                   | 0.051 0.438                  |
| 30°                                  | 0.116 0.365                        | 210°                   | 0.115 0.378                  |
| 40°                                  | 0.194 0.285                        | 220°                   | 0.192 0.282                  |
| 50°                                  | 0.283 0.203                        | 230°                   | 0.276 0.207                  |
| 60°                                  | 0.261 0.124                        | 240°                   | 0.354 0.128 <del>0.127</del> |
| 70°                                  | 0.428 0.058                        | 250°                   | 0.421 0.063                  |
| 80°                                  | 0.482 0.017                        | 260°                   | 0.466 0.018                  |
| 90°                                  | 0.499 0.000                        | 270°                   | 0.485 0.000                  |
| 100°                                 | 0.480 <del>0.003 0.015</del>       | 280°                   | 0.473 0.012                  |
| 110°                                 | 0.438 0.052                        | 290°                   | 0.448 0.051                  |
| 120°                                 | 0.378 <del>0.116</del>             | 300°                   | 0.365 0.115                  |
| 130°                                 | 0.292 0.194                        | 310°                   | 0.285 <del>0.192</del>       |
| 140°                                 | 0.207 0.283                        | 320°                   | 0.204 0.276                  |
| 150°                                 | 0.127 0.361                        | 330°                   | 0.124 0.356                  |
| 160°                                 | 0.063 0.428                        | 340°                   | 0.058 0.431                  |
| 170°                                 | 0.018 0.482                        | 350°                   | 0.017 0.466                  |

Table 3. Measurement data for the 1/4-wave plate (rotation angle 0°).

Instructor's signature: \_\_\_\_\_



| Rotation angle of the 1/4-wave plate: 20° |   |                                |  |
|---|---|--------------------------------|--|
| Maximum Electric Current $I_0$            |   | $0.398 \pm 0.001 \text{ [mA]}$ |  |
| $\theta$                                  | $I \text{ [mA]} \pm 0.001 \text{ [mA]}$                             | $\theta$                       | $I \text{ [mA]} \pm 0.001 \text{ [mA]}$                  |
| 0°  | 0.076 0.396   | 180°                           | <del>0.397</del> <del>0.426</del> 0.422 0.078            |
| 10°                                       | 0.049 0.373   | 190°                           | <del>0.378</del> <del>0.407</del> <del>0.407</del> 0.049 |
| 20°                                       | 0.041 0.342   | 200°                           | <del>0.345</del> <del>0.372</del> <del>0.357</del> 0.041 |
| 30°                                       | 0.055 0.293   | 210°                           | <del>0.296</del> <del>0.323</del> 0.055                  |
| 40°                                       | 0.089 0.238   | 220°                           | <del>0.235</del> <del>0.250</del> 0.082                  |
| 50°                                       | 0.127 0.178   | 230°                           | <del>0.177</del> <del>0.188</del> 0.143                  |
| 60°                                       | 0.198 0.121   | 240°                           | <del>0.120</del> <del>0.127</del> 0.209                  |
| 70°                                       | 0.260 0.076   | 250°                           | <del>0.078</del> 0.265                                   |
| 80°                                       | 0.312 0.049   | 260°                           | <del>0.049</del> 0.312                                   |
| 90°                                       | 0.353 <del>0.344</del> 0.041  | 270°                           | <del>0.041</del> 0.356                                   |
| 100°                                      | 0.386 <del>0.359</del> <del>0.055</del>                             | 280°                           | <del>0.055</del> 0.385                                   |
| 110°                                      | <del>0.397</del> <del>0.077</del> <del>0.088</del>                  | 290°                           | <del>0.072</del> 0.386                                   |
| 120°                                      | <del>0.378</del> <del>0.150</del> <del>0.127</del>                  | 300°                           | <del>0.140</del> 0.375                                   |
| 130°                                      | <del>0.343</del> <del>0.215</del> <del>0.198</del>                  | 310°                           | <del>0.201</del> 0.342                                   |
| 140°                                      | <del>0.316</del> <del>0.284</del> <del>0.260</del>                  | 320°                           | <del>0.263</del> 0.313                                   |
| 150°                                      | <del>0.235</del> <del>0.346</del> <del>0.338</del> <del>0.312</del> | 330°                           | <del>0.317</del> 0.238                                   |
| 160°                                      | <del>0.177</del> <del>0.373</del> <del>0.386</del> <del>0.353</del> | 340°                           | <del>0.356</del> 0.178                                   |
| 170°                                      | 0.120 <del>0.401</del> <del>0.413</del> <del>0.386</del>            | 350°                           | <del>0.385</del> 0.121                                   |

Table 4. Measurement data for the 1/4-wave plate (rotation angle 20°).

Instructor's signature: \_\_\_\_\_



| Rotation angle of the 1/4-wave plate: 45°             |                               |          |                               |
|---|-------------------------------|----------|-------------------------------|
| Maximum Electric Current $I_0$ $0.21 \pm 0.001 \mu A$ |                               |          |                               |
| $\theta$  | $I [\mu A] \pm 0.001 [\mu A]$ | $\theta$ | $I [\mu A] \pm 0.001 [\mu A]$ |
| 0°  | 0.172                         | 180°     | 0.173                         |
| 10°   | 0.178                         | 190°     | 0.182                         |
| 20°   | 0.186                         | 200°     | 0.187                         |
| 30°   | 0.193                         | 210°     | 0.196                         |
| 40°   | 0.210                         | 220°     | 0.196                         |
| 50°   | 0.215                         | 230°     | 0.200                         |
| 60°   | 0.217                         | 240°     | 0.208                         |
| 70°   | 0.210                         | 250°     | 0.206                         |
| 80°   | 0.202                         | 260°     | 0.198                         |
| 90°   | 0.210                         | 270°     | 0.190                         |
| 100°  | 0.193                         | 280°     | 0.181                         |
| 110°  | 0.183                         | 290°     | 0.171                         |
| 120°  | 0.178                         | 300°     | 0.166                         |
| 130°  | 0.175                         | 310°     | 0.155                         |
| 140°  | 0.176                         | 320°     | 0.157                         |
| 150°  | 0.165                         | 330°     | 0.160                         |
| 160°  | 0.167                         | 340°     | 0.158                         |
| 170°  | 0.170                         | 350°     | 0.160                         |

Table 5. Measurement data for the 1/4-wave plate (rotation angle 45°).

| Rotation angle of the 1/4-wave plate: 70° |       |
|---|-------|
| $\theta [^\circ] \pm [2]^\circ$           | 0.317 |
| $I [\mu A] \pm 0.001 [\mu A]$             | 74    |

Table 6. Measurement data for the 1/4-wave plate (rotation angle 70°).

Instructor's signature:

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