

# 社團法人中國工程師學會 函

地址：新竹市大學路 1001 號工程六館  
本案聯絡人：鄭薇詩教授、楊朝堯教授  
聯絡電話：03-5712121 分機 31322  
電子郵件：[cia2025.nycu@gmail.com](mailto:cia2025.nycu@gmail.com)

110

臺北市信義區吳興街 250 號

受文者：臺北醫學大學醫學工程學院

發文日期：中華民國 115 年 4 月 30 日

發文字號：中工秘字第 1150740268 號

速別：速件

密等及解密條件或保密期限：普通

附件：如說明五

主旨：本學會辦理「115 年中國工程師學會學生分會工程論文競賽」，敬請惠予公告並轉知學生踴躍投稿，請查照。

說明：

- 一、為鼓勵大學生積極參與工程專題研究，進而在未來工作職場上，能學以致用，成為學養俱優之青年工程師，特舉辦此項競賽。
- 二、徵稿相關說明如次：
  - (一) 徵稿期限：即日起至 115 年 5 月 31 日止。
  - (二) 徵稿對象：全國各大學校院相關學系之大學生。
  - (三) 線上投稿論文摘要完成報名，並於競賽當天進行實體海報報告決選（詳見競賽辦法）。
  - (四) 活動網站：<https://sites.google.com/nycu.edu.tw/cie2026>
  - (五) 本競賽如有增修說明事宜，得隨時修正後另行公布，且依照各領域報名人數情況，主辦單位得評估論文屬性，重新分配投稿論文之工程領域。詳情請以活動網頁最新公告為據。
- 三、為廣納各界學子專題，尚未建立中工會學生分會學校之專題論文，請指導教授推薦即可。

四、本案召集人：中國工程師學會教育委員會教育小組召集人  
陳三元終身講座教授；本案執行秘書兼承辦人：黃爾文教  
授、鄭薇詩教授、楊朝堯教授。

五、檢附「115年度中國工程師學會學生分會工程論文競賽辦法  
」、論文競賽摘要投稿範本（附件一）及推薦表（附件二）

正本：公私立大專院校工學院、電資學院及智慧機電學院

副本：本學會教育委員會、本學會教育委員會教育小組

理事長

楊朝堯

## 中國工程師學會學生論文競賽摘要投稿範本 (16 號標楷體)

作者一、作者二、與作者三... (12 號標楷體，必要時可用多行來詳列多位作者)

單位(學校)名稱、城市、郵遞區號、國家(12 號標楷體，必要時可用多行來詳列)

### 摘要

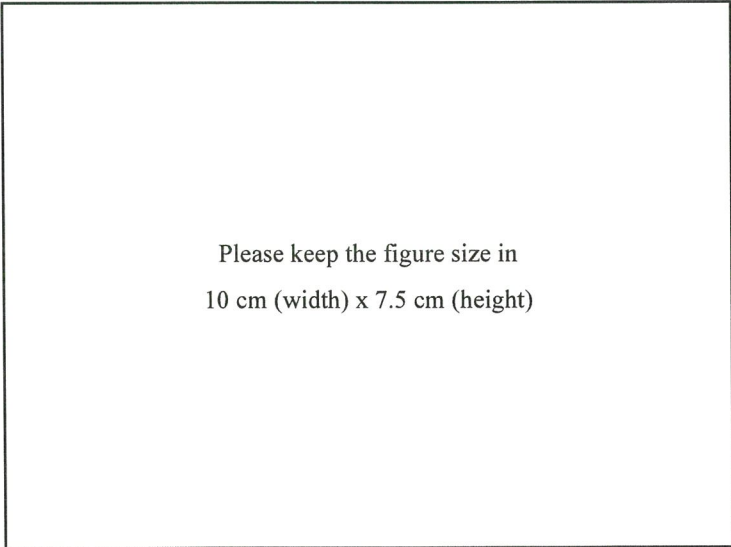
論文撰寫中英文皆可，請選用標楷體之中文字型及 Times New Roman 之英文字型，並附註論文研究重點數據(圖)一張，含圖註解去重點呈現本篇論文的研究成果。整篇以一頁 A4 為限。

**關鍵詞：**以不超過六個為原則。

### Abstract

The abstract can be written in either Chinese or English (in Times New Roman style). Additionally, please include one representative figure relevant to the work to highlight the results, along with an appropriate caption. Please keep the submitted file within one page.

**Keywords:** No more than six.



Please keep the figure size in  
10 cm (width) x 7.5 cm (height)

圖、請附註一個詳細的圖解，若有多個圖，最好用一圖組來表示，並請標註(a) (b) (c) (d)...

Fig. Please give a concise caption for the provided figure. For a figure set, please label (a) (b) (c) (d)... in sequence if needed.

(範本)

# Spin–Orbit Torque Booster in an Antiferromagnet via Facilitating a Global Antiferromagnetic Order: A Route toward an Energy-Efficient Memory

Hao-Kai Chang<sup>1</sup>, Kuan-Yu Chi<sup>2</sup>, Yu-Lon Lin<sup>1</sup>, Yu-Hsien Lai<sup>1</sup>, Yen-Lin Huang<sup>1</sup>, Chi-Feng Pai\*, Chao-Yao Yang<sup>1\*</sup>

<sup>1</sup>Department of Materials Science and Engineering, National Yang Ming Chiao Tung University, Hsinchu 300093, Taiwan

<sup>2</sup>Department of Materials Science and Engineering, National Taiwan University, Taipei 10617, Taiwan

<sup>3</sup>Center for Emergent Functional Matter Science, National Yang Ming Chiao Tung University, Hsinchu 300093, Taiwan

## Abstract

Spin transport and the associated spin torque effects in antiferromagnets (AFMs) are scientifically interesting but have remained elusive due to the varied observations of spin transport in AFMs. This study revisits the role of a global Néel order in nickel oxide (NiO) facilitated through a spin–orbit torque (SOT) and examines the enhanced SOT efficiency in a heavy metal (W)/AFM (NiO)/ferromagnet (FM, CoFeB) trilayer with varying NiO thicknesses ranging from 1 to 5 nm. At the as-grown state, the Néel order of NiO is randomly oriented due to the polycrystalline nature of the film structure, leading to increased spin absorption and blocking spin transport from the adjacent W layer. When the spin current amplitude exceeds a threshold value, SOT enables reorientation of the Néel order in NiO to an equilibrium state, forming a global Néel order aligned with the applied current. This long-range Néel order reduces spin absorption and enhances spin transport through NiO, hence boosting the SOT efficiency in the adjacent CoFeB layer. X-ray magnetic linear dichroism spectroscopy and rewritable Néel order reorientation experiments in a device with orthogonal geometry confirmed the strong correlation between the global Néel order facilitation and the boosted SOT efficiency, which is enhanced larger than 4-fold for both damping- and field-like torques in the trilayer with 5 nm NiO. This study not only reveals the strong correlation between globally facilitated Néel order and spin transport in NiO but also offers a promising manner to promote AFM-based SOT devices toward energy-efficient computing technology.

**Keywords:** Antiferromagnet, Néel order, Spin-orbit torque, X-ray magnetic linear dichroism, Magnon, Easy-plane

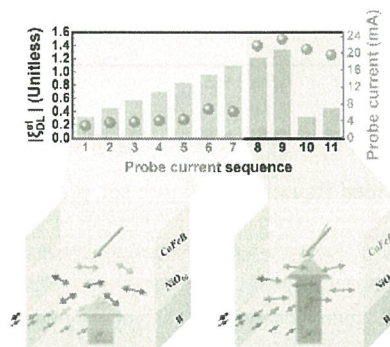


Fig. This work reports a spin-orbit torque (SOT) booster in antiferromagnet functioning to promote the spin conductivity and enhance SOT efficiency to meet the requirement of energy-efficient technology.

\*This work is cited from H. K. Chang et al., *ACS Appl. Mater. & Interfaces* **16**, 65037–65045 (2024).



