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| **Университет ИТМО**  **Физико-технический мегафакультет**  **Физический факультет** | **Изображение выглядит как Шрифт, логотип, Графика, текст  Автоматически созданное описание** |

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| Группа З220 | К работе допущен |
| Студент Гафурова Фарангиз Фуркатовна | Работа выполнена |
| Преподаватель Терещенко Георгий Викторович | Отчет принят |

**Рабочий протокол и отчет по лабораторной работе 3.13**

**Магнитное поле Земли**

1. **Цель работы**

Исследование силовых характеристик магнитного поля Земли

1. **Задачи, решаемые при выполнении задачи**

* Провести измерения направления суммарного магнитного поля, создаваемого Землей и системой катушек Гельмгольца.
* Определить горизонтальную составляющую магнитного поля Земли.

1. **Объект исследования**

* Суперпозиция магнитного поля колец Гельмгольца и геомагнитного поля.

1. **Метод экспериментального исследования**

* Многократные прямые измерения физической величины с последующей обработкой.

1. **Рабочие формулы и исходные данные**

Физические величины:

– индукция магнитного поля в пространстве между кольцами

- горизонтальная составляющая вектора индукции магнитного поля Земли

– величина магнитного поля катушек Гольмгольца

– сила тока в катушках

– среднее значение силы тока

– число витков (100)

– радиус колец ()

– угол между направлением пробного поля и земного магнитного поля (1600)

– угол между направлением результирующего поля и земного магнитного поля

Формулы:

1. **Измерительные приборы**

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1. **Схема установки**

Изображение выглядит как круг

Контент, сгенерированный ИИ, может содержать ошибки.

Рисунок 1. Параметры установки R = 0.15 м - радиус катушек;

n = 100 - число витков в каждой из катушек

1. **Результаты прямых измерений и их обработки**

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1. **Расчет результатов косвенных измерений (таблицы, примеры расчетов)**

*Примеры расчетов:*

Нашли значения магнитной индукции катушек Гельмгольца по формуле (1) и средних значений токов, а потом по МНК узнаем значение коэффициента в линейно зависимости .

1. **Графики**

*График 1: Зависимость магнитной индукции от коэффициента*

Изображение выглядит как линия, График, текст, снимок экрана

Контент, сгенерированный ИИ, может содержать ошибки.

1. **Окончательные результаты**

1. **Выводы и анализ результатов**

В результате проделанной лабораторной работы были получены следующие теоретические сведения: для оценки значения горизонтальной составляющей магнитной индукции геомагнитного поля необходимо создать магнитное поле катушек Гельмгольца и регистрировать суперпозицию таких векторов магнитной индукции. В зависимости от угла поворота магнитной стрелки под действием поля колец можно по теореме синусов узнать зависимость значений магнитной индукции колец (формула для которых известна из теории и в нашем случае зависит от силы тока) от коэффициента .

Значение получили меньше, чем истинное (14.92 мкТл в Санкт-Петербурге), но это можно объяснить неточностью в измерениях и неидеальностью установки.

P 64 a

I usually have to wait longer because my turn is slower.

b

Murphy was an American aerospace engineer. His “Law” is if there is something that can go wrong, it will go wrong.

с

1 D 2 H 3 B 4 C 5 A 6 F 7 E 8 G

d

It often happens to me that when I decide to walk, when the bus doesn't run for a long time, it arrives as soon as I take a few steps.

P 65 a

1 recession 2 applied for 3 got cut off 4 either, or

5 in the wild 6 the whole morning

b

Peter waited four months for a job interview, but when the phone call finally came for an interview, the call got cut off.

Sue got up early for a trip to see a tiger, but didn't see one. However, other people who went on a trip to see birds saw the tiger.

С

1 F (Peter did maths at university.)

2 T

3 F (Peter couldn't call them back because his phone said

'unknown number')

4 T

5 F (The guide wasn't optimistic about seeing the tiger.)

6 F (Sue enjoyed her trip.)

P 71

1. If I saw a mouse in my kitchen, I would try to catch it gently with a container and release it outside.

2. If I saw a dog attacking someone, I would try to distract the dog if it was safe to do so, like throwing something in the opposite direction.

3. If a bird or a bat flew into my bedroom, I would open the window wide and try to guide it towards the opening so that it could fly out.

4. If I saw a large spider in the bath, I wouldn't panic. I would use a cup and a piece of cardboard to carefully move it outside.

5. If it was a very hot day and I was on a beach that was famous for shark attacks, I would stay on the shore and enjoy the sun and the view.

6. If someone offered to buy me a fur coat, I wouldn't accept it. I believe in protecting animals and would choose a more ethical and sustainable alternative.

7. If my neighbour's dog barked all night, I would talk to my neighbour politely and explain the problem, hoping that they could find a way to make their dog quiet at night.

8. If a friend asked me to look after their cat or dog for the weekend, I would be happy to do it if I had the time and resources. I love animals and would take good care of them.

9. If I went to somebody's house for dinner and they gave me horse meat, I would be a bit surprised as it's not a common dish in my culture. But I would still try a small piece out of respect for their hospitality.

10. If I went to somebody's house for dinner and they gave me goat, I would be curious to taste it as I haven't had it often. I would enjoy the new culinary experience.

11. If I went to somebody's house for dinner and they gave me kangaroo, I would be quite intrigued. I know it's more common in some countries, and I would be willing to try it to expand my food horizons.

P 141 8b a

1. D
2. G
3. E
4. F
5. A
6. B

b

1. If you tell me what really happened, I won't tell anybody else.

2. If I don't write it down, I won't remember it.

3. Will you call me if you get any news?

4. She will help you if you ask her nicely.

5. I will phone you if I hear from Alex.

6. You will miss your friends if you move to Paris.

7. If you listen carefully, you will understand everything.

8. Your boss won't be pleased if you are late for work today.

9. I will drive you home if you give me directions.

10. If you don't take an umbrella, it will rain!

P 143 9a a

1. E
2. D
3. C
4. G
5. F
6. B

b

1. We'd get a dog if we had a garden.

2. If you tried Indian food, I'm sure you'd like it.

3. I wouldn't buy it if I didn't like it.

4. If we hired a car, we could drive to the mountains.

5. We'd see our children more often if they lived nearer.

6. I wouldn't go to that restaurant if I were you – it's very expensive.

7. You'd learn more if you did more homework.

8. I'd cycle to work if the traffic weren't so bad.

9. Would you work abroad if you found a well - paid job?

10. I wouldn't be happy if I had to leave.

P 72 a

I'm a little afraid to drive when there are a lot of cars on the road.

b

1 Fear of driving 2 Fear of butterflies 3 Fear of doctors 4 Fear of heights 5 Fear of crowds

с

A 3 B 1 C 2 D 5 E 4

P 73 a

Julia:

1 Spiders

2 Since she was 12

3 A very big spider went across the room in the flat where she lived.

4 She's better now and can sit in same room as a spider, but not for long. In the past it affected her a lot - she couldn't sit in the same room as a spider, always kept doors and windows shut.

5 Yes

Chloe:

1 Buttons

2 Since she was six or seven months old

3 Her mum tried to dress her in a cardigan with buttons.

4 She has problems buying winter coats, as there aren't many that don't have buttons. She doesn't like hugging people who are wearing clothes with buttons. Her mum had to adapt her school uniform.

5 No