The first Question: **Asked by Swara , a student as mentioned in the Email text [on email ajoy.plus@gmail.com, 23.1.2024]. The question is a paragraph about my general motivation for such research. How and why Newton's third law of motion is generalized? It has also been pointed out that I have quoted in an interview in a video, that it is prospective work for the Nobel Prize in physics.**

Ajay Sharma Replied (24 January 2024)

We say a basketball (spherical) and a rugby ball (an oval shape) fall and rebound upward, it is an example of Newton's third law. But it is a qualitative explanation only. We aim to explain this observation quantitatively. This is the initial point that is the cause of this debate.

(i) **Consideration at the macroscopic level:** In the case of freely falling and rebounding bodies Newton's Third Law **[Action (F_{AB}) = -Reaction (F_{BA})];** is explained QUALITATIVELY only.
These are daily life experiments, that need to be conducted as have not been conducted in the past 338 years. The experimental method is discussed with simplicity in the section in https://newton99.com/third-law/ article no 3.
For confirmation of the third law, two conditions must be satisfied, firstly action must be equal to reaction, and secondly, the direction of reaction must be exactly opposite.

(ii) **Application of the Third Law:** As the body (ball, say) strikes the floor, then it exerts action (F_{AB}) on the floor; as the floor also exerts a mutual simultaneous force on the body (ball) as reaction (F_{BA}). In such observations, shape, composition, target, etc. are significant, hence these are significant factors but neglected by Newton's third law **[Action (F_{AB}) = -Reaction (F_{BA})].**
To understand the effect of shape in such observations, the composition, mass, target, etc. all are kept the same (the bodies are so fabricated purposely). Only the shape of bodies is different. Any anomalous effect would be due to the SHAPE of the body only.
(iii) Equations based on The Third Law: The bodies may be spherical, semi-spherical, cone, polygon, triangle, long thin pipe, flat or distorted SHAPE, as the mass of each body is regarded as 1kg (say), then action would be
Action = Force = Weight = mg = 1kg x 9.8 m/s^2 = 9.8 Newtons
Then according to the third law
Action = - Reaction = 9.8 newtons (opposite in direction).
So all bodies must rebound to the original height (1m, say), retracing the original path; as action and reaction are equal (9.8 newtons) in magnitude and opposite in direction.

$(iv)_a$ **Spherical Ball**

Under certain conditions, the spherical ball may rebound to its original height (1m, say) exactly

retracing the same point. The action and reaction are equal in magnitude but opposite in direction. So, Newton's third law **[Action (F_{AB}) = -Reaction (F_{BA})],** may be regarded as working very well (quantitatively obeyed) in this case.

$(iv)_b$ Bodies of different shapes

(Spherical, semi-spherical, cone, triangle, polygon, long thin pipe, flat, bodies of irregular shape, etc.). The bodies have the same mass (1kg), composition, target, etc., hence they have the same action and reaction i.e. 9.8 Newtons but opposite in direction.

(v) **Observations:** As mass is the same (action is same) the reaction would be the same for all bodies but opposite in direction. But different bodies rebound to different heights in different directions. Thus, Newton's third law is not obeyed, in such cases. So, SHAPE is a significant factor in such observations.

Such experiments are not reported anywhere, so these are original and required.

(vi) Generalization of Third Law

(Generalized because of the actual experimental situation)

Thus in such observations, the various factors (shape, composition, target, some other relevant factors etc.) are significant and need to be taken into account. These are NOT taken into account by Newton's original third law **[Action (F_{AB}) = -Reaction (F_{BA})];** these may be taken into account by generalizing the same within the domain of Newtonian Mechanics.

Thus the generalized form of the law is (Q. 7) in https://newton99.com/videos/

$$\text{Reaction } (F_{BA}) = -\text{ Action } (F_{AB})\ [(K_{shape} \times K_{composition} \times K_{target} \times K_{other}] \qquad (5)$$

It can be experimentally confirmed. Many scientists and scientific institutions have approved these experiments some reports are in the Author Reply Tab, https://newton99.com/author-reply/

To conduct experiments, a method is described in https://newton99.com/third-law/ article no 3.

(vii) Nobel Prize in Physics

I attended a conference of the **American Association of Physics Teachers in Washington in 2018.** Then one of the American scientists said that if Eq.(5) is experimentally confirmed, India would get the Nobel Prize.

I have listened to different comments for this work by various people, and it is also a comment, so I mention it. Some simple experiments costing 15-20 Lakhs with existing facilities of ISRO or DRDO or HAL etc. will make results feasible in about 6 months. An American scientist has given this unbiased opinion, I do not doubt this. Just precise quantitative experiments are needed.

(viii) Why these simple experiments are not conducted?

Now scientists have touched the Moon and Mars and have gone very near the Sun, have established laboratories like CERN, then why such simple school-level experiments have not

been done? These experiments would cause the biggest-ever change in science.

(ix) Frank and quantitative analysis of Newton's Third Law of Motion.

It is a debate, and some useful results would be the outcome.
I am absolutely clear what I am saying.
There is no exaggeration but also frank, scientific, and quantitative analysis of such observations. If one feels Newton's Third Law does not apply to such phenomena, then why it is not applicable? Then how to explain this or such simple observations that have prevailed for many millennia?
During experiments, furthermore, deep technical issues have to be sorted out.

(x) Link to Newton's Mathematical Principles of Natural Philosophy (The Principia)

[1] Isaac Newton, *Mathematical Principles of Natural Philosophy* (London: Middle Temple Gate in Fleet Street) Vol.1 Book I Third Law p 19-20 (1729)
https://books.google.co.in/books?id=Tm0FAAAAQAAJ&pg=PA1&redir_esc=y&hl=en#v=onepage&q&f=false

(xi) Further questions /queries requested from readers, will be answered on this page
Please quote the paragraph number for the specific query it will help me to respond better.

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Ajay Sharma 24 January 2024
The book
Newton's Laws of Motion in the 21st Century …… will see the day of the light soon.